IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

CIENA CORPORATION	§	
	§	
Plaintiff	§	
	§	
vs.	§	**CASE NO. 2:05 CV 14**
	§	
NORTEL NETWORKS INC.,	§	
NORTEL NETWORKS CORP.	§	
NORTEL NETWORKS LIMITED	§	
	§	
Defendants	§	

MEMORANDUM OPINION

This Claim Construction Opinion construes terms in United States Patent Nos. 5,978,115 ("the '115 patent"); 6,618,176 ("the '176 patent"); 5,715,076 ("the '076 patent"); 6,163,392 ("the '392 patent"); 6,278,535 ("the '535 patent"); 4,667,324 ("the '324 patent"); 4,736,363 ("the '363 patent"); 6,205,142 ("the '142 patent"); 5,841,760 ("the '760 patent"); and 6,496,519 ("the '519 patent").

BACKGROUND

In the present case, Ciena Corporation ("Ciena") asserts nine patents against Nortel Networks, Inc. ("Nortel"), and Nortel asserts thirteen patents against Ciena. On August 31, 2005, the Court ordered the case tried in stages and indicated the twelve patents that would be at issue in stage one. Additionally, the Court stayed all claims related to the remaining patents in the case. This Claim Construction Opinion addresses the five Ciena and five of the seven Nortel patents at issue in stage one of the case.[1] The five Ciena patents that Ciena accuses Nortel of infringing addressed

[1] The parties do not dispute the construction of any terms in Nortel's U.S. Patent No. 5,608,733 or Nortel's U.S. Patent No. 6,084,69. Therefore, these patents are not addressed in this Claim Construction Opinion.

in this Claim Construction Opinion are Ciena's '076, '176, '115, '392, and '535 patents. Similarly, the five Nortel patents that Nortel accuses Ciena of infringing addressed in this Claim Construction Opinion are Nortel's '324, '760, '519, '363, and '142 patents. The patents at issue in this case relate to optical networking technology. Optical networks are telecommunications networks that transmit information over bundles of fiber-optic cable using optical signals, or light signals.

1. Ciena Patents

Optical networks carry optical channels of a single wavelength over one or more optical waveguides, such as one fiber-optic strand within a fiber-optic cable. An increase in communications services combined with the limited size of the existing fiber-optic networks and the prohibitive cost of laying more fiber-optic cable created a need to increase the capacity of the existing fiber-optic waveguides. Wavelength division multiplexing is a system that was developed to increase the capacity of existing optical waveguides. Multiplexing is the process of combining rate signals for transmission over a telecommunications system. It is often necessary to multiplex lower speed digital signals into higher speed digital signals for transmission over a network. In a wavelength division multiplexing system, multiple optical signal channels are combined and carried over a single waveguide by each channel being assigned a different wavelength. Optical amplifiers are used to amplify multiple optical channels simultaneously, allowing the wavelength division multiplexing system to transfer information over long-distance optical networks. Optical signals are usually transported through more than one optical network before reaching their final destination. Networks receiving an optical signal often employ a different wavelength channel than the wavelength channel used by the transmitting network to transmit the optical signal. Therefore, a system is needed to convert a signal from the wavelength channel used by the transmitting network

to the wavelength channel used by the receiving network.

The '076 patent discloses a remodulating channel selector ("remodulating selector") for a wavelength division multiplexing optical communication system. The remodulating selector can receive a wavelength division multiplexing signal at a certain wavelength channel from one optical network, extract information transmitted on one wavelength channel, and then send the same information out on a different optical network using a different wavelength channel. The invention allows different optical communication devices and networks to communicate with each other, no matter what wavelength channel each network is capable of transmitting or receiving.

Similarly, the '176 patent, a continuation-in-part of the '076 patent, discloses a remodulating selector that can be used with wavelength division multiplexing optical communications networks. The '176 patent is different from the '076 patent in that it discloses a remodulating selector designed for use with a dense wavelength-division multiplexing system. The use of dense wavelength division multiplexing allows the output optical channels of the '176 patent to carry additional information. Furthermore, the remodulating selector disclosed in the '176 patent incorporates Forward Error Correction ("FEC") codes into the optical signals it transmits. The FEC codes incorporated into the optical signals are used by the receiving optical network to verify that the information it receives is correct.

The '115 patent discloses an optical network communication system in which multiple network elements found along the network path exchange information over a service channel for the purposes of monitoring and controlling the system. The network communication system uses node control processors that are associated with each element of the network and transmit identification and status information to other node control processors within the network. These communications

between the node control processors allow the network to take automatic corrective action in response to a fault or a change in operational parameters.

The ‘392 patent also discloses an optical network communication system similar to that disclosed in the ‘115 patent. The network system is designed so that elements of the network can communicate identification and status information throughout the network on a service channel, which allows the network to take corrective action when various faults occur within the network. However, the ‘392 patent is different from the ‘115 patent in that it discloses the use of the invention in conjunction with a wavelength division multiplexing communication system.

The ‘535 patent discloses a method for monitoring messages on a wavelength division multiplexing network using a plurality of frames, each frame conforming to the Synchronous Optical Network (“SONET”) standard. The SONET standard defines a way of transmitting information on optical networks by breaking the information into small units called frames. A plurality of optical receiver and transmitter modules are found on each optical selector throughout the wavelength division multiplexing network. The transmitter and receiver modules extract one byte from each of the plurality of frames. The successive bytes are then grouped as messages that are stored such that consecutive messages can be compared with, or checked against, a predetermined message.

2. Nortel Patents

The ‘324 patent discloses a time-division multiplexed digital transmission system. The invention discloses a system that “utilizes single stage multiplexing and demultiplexing of both synchronous and/or asynchronous bit streams from tributaries of widely differing bit rates,” or speeds. Col. 1:6-8. This allows “direct access to individual synchronous channels, or to complete synchronous or asynchronous tributaries,” without having to completely demultiplex the higher

speed signal. Col. 1:9-11.

The ‘363 patent discloses a path oriented routing system and a method for packet switching networks with end-to-end internal protocols. The invention “allows the same switch pairs to communicate over multiple paths (for better network throughput), while maintaining knowledge of user connections at the network’s endpoints only.” Col. 1:32-35. The method allows existing traffic to maintain its existing paths while newer traffic can be assigned to the new shortest path. This helps minimizes packet disordering and creates stable multiple path routing.

The ‘142 patent discloses a mechanism for sending digital data in Asynchronous Transfer Mode cells “over multiple slower transmission links.” Col. 1:10-11. The invention describes a method for inverse multiplexing a series of Asynchronous Transfer Mode cells over one or more transmission links of slower speeds. Inverse multiplexing occurs when digital data in Asynchronous Transfer Mode cells is sent to a destination node over more than one transmission link in a specific round robin order. The invention also provides a method for cell stuffing to accommodate non-synchronized links.

The ‘760 patent discloses a method for configuring SONET transport nodes that allow the “transparent transport” of lower bit rate digital signals over a high bit rate span of a telecommunication system. The patent defines transparent transport as “the ability to provide continuity of all payloads and associated overhead bytes necessary to maintain a lower bit rate linear or ring system through a higher bit rate midsection.” Col. 1:42-45. The invention allows the lower bit rate linear or ring system to operate as if it were directly connected without being connected by a higher bit rate midsection.

The ‘519 patent discloses a method for carrying data frame traffic from a local area network

over a wide area network transported on a long distance high capacity synchronous digital network. The frame based date communication network is interfaced with the synchronous digital network using multiple frame based data port cards incorporated into multiple synchronous multiplexers. The invention enables frame based data to be directly incorporated into a synchronous virtual container without encapsulation in an intermediate protocol.

APPLICABLE LAW

"It is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (quoting *Innova/Pure Water Inc. v. Safari Water Filtration Sys., Inc.*, 381 F.3d 1111, 1115 (Fed. Cir. 2004)). In claim construction, courts examine the patent's intrinsic evidence to define the patented invention's scope. *See id.*; *C.R. Bard, Inc. v. U.S. Surgical Corp.*, 388 F.3d 858, 861 (Fed. Cir. 2004); *Bell Atl. Network Servs., Inc. v. Covad Commc'ns Group, Inc.*, 262 F.3d 1258, 1267 (Fed. Cir. 2001). This intrinsic evidence includes the claims themselves, the specification, and the prosecution history. *See Phillips*, 415 F.3d at 1314; *C.R. Bard, Inc.*, 388 F.3d at 861. Courts give claim terms their ordinary and accustomed meaning as understood by one of ordinary skill in the art at the time of the invention in the context of the entire patent. *Phillips*, 415 F.3d at 1312-13; *Alloc, Inc. v. Int'l Trade Comm'n*, 342 F.3d 1361, 1368 (Fed. Cir. 2003).

The claims themselves provide substantial guidance in determining the meaning of particular claim terms. *Phillips*, 415 F.3d at 1314. First, a term's context in the asserted claim can be very instructive. *Id*. Other asserted or unasserted claims can also aid in determining the claim's meaning because claim terms are typically used consistently throughout the patent. *Id*. Differences among the claim terms can also assist in understanding a term's meaning. *Id*. For example, when a

dependent claim adds a limitation to an independent claim, it is presumed that the independent claim does not include the limitation. *Id*. at 1314-15. Claims "must be read in view of the specification, of which they are a part." *Id*. at 1315. (quoting *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 978 (Fed. Cir. 1995)). "[T]he specification 'is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.'" *Id*. (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)); *Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1325 (Fed. Cir. 2002). This is true because a patentee may define his own terms, give a claim term a different meaning than the term would otherwise possess, or disclaim or disavow the claim scope. *Phillips*, 415 F.3d at 1316. In these situations, the inventor's lexicography governs. *Id*. Also, the specification may resolve ambiguous claim terms "where the ordinary and accustomed meaning of the words used in the claims lack sufficient clarity to permit the scope of the claim to be ascertained from the words alone." *Teleflex, Inc.*, 299 F.3d at 1325. But, "although the specification may aid the court in interpreting the meaning of disputed claim language, particular embodiments and examples appearing in the specification will not generally be read into the claims." *Comark Commc'ns, Inc. v. Harris Corp.*, 156 F.3d 1182, 1187 (Fed. Cir. 1998); *see also Phillips*, 415 F.3d at 1323. The prosecution history is another tool to supply the proper context for claim construction because a patent applicant may also define a term in prosecuting the patent. *Home Diagnostics, Inc., v. Lifescan, Inc.*, 381 F.3d 1352, 1356 (Fed. Cir. 2004) ("As in the case of the specification, a patent applicant may define a term in prosecuting a patent.").

Although extrinsic evidence can be useful, it is "less significant than the intrinsic record in determining 'the legally operative meaning of claim language.'" *Phillips*, 415 F.3d at 1317 (quoting

C.R. Bard, Inc., 388 F.3d at 862). Technical dictionaries and treatises may help a court understand the underlying technology and the manner in which one skilled in the art might use claim terms, but technical dictionaries and treatises may provide definitions that are too broad or may not be indicative of how the term is used in the patent. *Id.* at 1318. Similarly, expert testimony may aid a court in understanding the underlying technology and determining the particular meaning of a term in the pertinent field, but an expert's conclusory, unsupported assertions as to a term's definition is entirely unhelpful to a court. *Id.* Generally, extrinsic evidence is "less reliable than the patent and its prosecution history in determining how to read claim terms." *Id.*

The patent in suit also contains means-plus-function limitations that require construction. Where a claim limitation is expressed in "means plus function" language and does not recite definite structure in support of its function, the limitation is subject to 35 U.S.C. § 112, ¶ 6. *Braun Med., Inc. v. Abbott Labs.*, 124 F.3d 1419, 1424 (Fed. Cir. 1997). In relevant part, 35 U.S.C. § 112, ¶ 6 mandates that "such a claim limitation 'be construed to cover the corresponding structure . . . described in the specification and equivalents thereof.'" *Id.* (citing 35 U.S.C. § 112, ¶ 6). Accordingly, when faced with means-plus-function limitations, courts "must turn to the written description of the patent to find the structure that corresponds to the means recited in the [limitations]." *Id.*

Construing a means-plus-function limitation involves multiple inquiries. "The first step in construing [a means-plus-function] limitation is a determination of the function of the means-plus-function limitation." *Medtronic, Inc. v. Advanced Cardiovascular Sys., Inc.*, 248 F.3d 1303, 1311 (Fed. Cir. 2001). Once a court has determined the limitation's function, "the next step is to determine the corresponding structure disclosed in the specification and equivalents thereof." *Id.*

A "structure disclosed in the specification is 'corresponding' structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim." *Id*. Moreover, the focus of the "corresponding structure" inquiry is not merely whether a structure is capable of performing the recited function, but rather whether the corresponding structure is "clearly linked or associated with the [recited] function." *Id*.

THE '076 PATENT[2]

The '076 patent discloses a remodulating selector for a wavelength division multiplexing optical communication system. The remodulating selector can receive a wavelength division multiplexing signal at a certain wavelength channel from one optical network, extract information transmitted on one wavelength channel, and then send the same information out on a different optical network using a different wavelength channel. The invention allows different optical communication devices and networks to communicate with each other, no matter what wavelength channel each network is capable of transmitting or receiving.

Remodulating channel selector

The Court agrees with Ciena that this term does not require construction. Nortel argues that the term should be construed as either "an integrated optical interface between wavelength division transmission and further optical transmission," or, alternatively "an integrated device that receives a wavelength division multiplexed input signal, selects a particular optical channel from the input signal, and places the information from the selected signal onto a newly generated optical output signal." Nortel contends that the term must be construed such that it is an integrated unit. Nortel argues that claim 1 of the patent requires that each remodulating channel selector has an input and

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[2] Appendix A contains the relevant claims of the patents with the disputed terms in bold.

output port because the claim describes a remodulating channel selector comprising an "optical input port" and a "remodulating channel selector output port." Cols. 9:55-59; 10:1-23. Nortel cites *Innova/Pure Water*, 381 F.3d at 1118 for the proposition that a preamble term is a limitation on a claim "where it breathes life and meaning into a claim, but not where it merely recites a purpose or intended use of the invention." Nortel argues that the "remodulating channel selector" breathes life and meaning into the claim because the preamble recites the claimed invention itself. Nortel also argues that the term "remodulating channel selector" is a limitation because it appears in the claim in the context of "remodulating channel selector output port." Nortel contends that the body of the claim finds an antecedent basis in the preamble.

The term "remodulating channel selector" is a term found in the preamble of the '076 patent. However, the term is a name the inventor gave to the structure that encompasses the invention described in the patent. In *IMS Technology, Inc. v. Haas Automation, Inc.*, the Federal Circuit held that an inventor does not limit the scope of the claim by giving a descriptive name to a structurally complete invention. *See* 206 F.3d 1422, 1434 (Fed. Cir. 2000). Claim 1 of the '076 patent describes a structurally complete invention. Therefore, the name "remodulating channel selector" given to the structure by the inventor is not a limitation on the scope of the claim. Furthermore, the recitation of the term itself in the preamble does not breath life and meaning into the claim as Nortel contends. It simply indicates the name for the structure that is being claimed. Finally, the use of the term "remodulating channel selector" in conjunction with the term "output port" does not mean that the preamble provides a necessary antecedent to the claim, it is simply a reference in the claim to the output port of the claimed device. Accordingly, it is not necessary for the Court to construe the term.

Because the term does not require construction, Nortel's arguments that the term must be an

integrated unit are moot. Nortel also argues that Ciena is judicially estopped from making its present argument that the term "remodulating channel selector" should not be construed because of an argument Ciena made before a different court.[3] However, Ciena is not judicially estopped from making its current argument before this Court based on the arguments it made with different counsel in regards to a claim term in a different patent before a different court in a different case.

Optical input port

The Court agrees with Ciena that this term does not require construction. Nortel argues that the term should be construed as "the access point to an integrated module that receives wavelength division multiplexed optical signals." Nortel does not introduce any support for its use of the words "access point." In fact, Nortel does not present any support for its proposed construction of "optical input port" other than as it relates to its argument that the "remodulating channel selector" should be construed as an integrated unit. For the reasons discussed above, the Court does not define the term "remodulating channel selector" and, therefore, does not import a limitation that would require the "remodulating channel selector" to be an "integrated module." Moreover, "optical input port" is a term that would be well understood in the art to mean the input port for an optical signal. The specification indicates that this is how the "optical input port" is understood in terms of the invention. *See* Cols. 2:64-67; 7:30-34. "Words of a claim 'are generally given their ordinary and customary meaning.'" *Phillips*, 415 F.3d at 1312 (citing *Vitronics*, 90 F.3d at 1582). "[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of

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[3] In *Ciena Corp. v. Corvis Corp.,* No. 00-662-JJF (D. Del. Sept. 12, 2002) the Delaware District Court construed the term "remodulating channel selector" from Ciena's U.S. Patent No. 5,784,184 (the "'184 patent"). Ciena argued that the term should be construed as an integral unit. Nortel argues that Ciena is judicially estopped from arguing a different construction of a very similar term in the '076 patent because of its previous argument to the Delaware Court in *Covis*.

ordinary skill in the art in question at the time of the invention, ..." *Id*. at 1313. Accordingly, it is not necessary for the Court to construe the term.

<u>*Remodulating channel selector output port*</u>

The Court agrees with Ciena that this term does not require construction. Nortel argues that the term should be construed as "the access point through which optical signals exit an integrated module." Again, Nortel does not present any support for its proposed construction of "remodulating channel selector output port" other than as it relates to its argument that the "remodulating channel selector" should be construed as an integrated unit. As with "optical input port," Nortel offers no support for its use of the words "access point." For the reasons discussed above, the Court does not define the term "remodulating channel selector" and, therefore, does not import a limitation that would require the remodulating channel selector to be an "integrated module." The "remodulating channel selector output port" would be understood in the art as simply an output port for the remodulating channel selector output port. This plain meaning is indicated in the specification of the '076 patent. *See* Col. 9:9-11. For the reasons discussed above, it is not necessary for the Court to construe the term.

<u>*Optical channel selector*</u>

The Court agrees with Ciena's proposed construction and construes the term as a "device that selects a single optical channel from a wavelength division multiplexing input signal." Nortel argues that the term should be construed as "an apparatus that selects a single wavelength from a wavelength division multiplexed optical signal and terminates the remainder of the wavelengths." Nortel argues the specification demonstrates that the optical channel selector terminates the wavelength. The specification states:

> Channel selector 102 passes optical signals having wavelengths other than the channel wavelength to be processed by the remodulating channel selector. These non-selected channels pass through low reflectivity port 104 and exit the optical communication system. The low reflectivity port 104 may be an angled fiber cut, although any low reflectivity waveguide termination technique may be employed. The selected channel wavelength is reflected by channel selector 102 through splitter 103 onto optical path 106.

Col. 7:36-45. Nortel argues that because the signals that are passed by the channel selector 102 "exit the optical communication system," they are being terminated by channel selector 102.

This embodiment of the invention indicates that if any structure performs the function of terminating wavelengths it is low reflectivity port 104, not optical channel selector 102. Channel selector 102 simply "passes optical signals having wavelengths" other than the optical signal to be processed. Nortel's construction would exclude this embodiment set out in the specification. "The Court must always read the claims in view of the full specification. A claim construction that excludes a preferred embodiment . . . 'is rarely, if ever, correct.'" *SanDisk Corp. v. Memorex Prods., Inc.*, 415 F.3d 1278, 1285 (Fed. Cir. 2005)(citing and quoting *Vitronics,* 90 F.3d at 1582-83). Furthermore, the specification specifically states that "an optical channel selector optically communicates with the optical input port to select a single optical channel from the [wavelength division multiplexing] input signal." Col. 3:1-3. Accordingly, the Court construes "optical channel selector" as a "device that selects a single optical channel from a wavelength division multiplexing input signal."

THE '176 PATENT

The '176 patent, a continuation-in-part of the '076 patent, discloses a remodulating selector that can be used with wavelength division multiplexing optical communications networks. The '176

patent is different from the '076 patent in that it discloses a remodulating selector designed for use with a dense wavelength division multiplexing system. The use of dense wavelength division multiplexing allows the output optical channels of the '176 patent to carry additional information. Furthermore, the remodulating selector disclosed in the '176 patent incorporates Forward Error Correction ("FEC") codes into the optical signals it transmits. The FEC codes incorporated into the optical signals are used by the receiving optical network to verify that the information it receives is correct.

Encoded; encoders; configured to encode; encoding

The Court adopts Ciena's proposed construction and construes the terms respectively as "adding coding bits; component(s) for adding coding bits; configured to add coding bits; having coding bits added." Nortel argues that the terms should be construed such that "the coding referred to in each of the terms involves appending a bit stream containing coding bits." Nortel argues that the '176 patent teaches a method for encoding FEC bits in an optical signal that increases the bit rate of the optical signal. Nortel contends that the patent requires that FEC bits are encoded into an overhead bit stream. Nortel claims that the specification supports its construction by offering the sole explanation of how to encode FEC bits through adding them to individual optical channels. *See* Col. 6:28-32. Nortel argues that Column 6, Lines 47 through 52 of the specification further "explains that the addition of FEC 'enables' a channel trace function that also 'encodes' channel identification, source, and destination into a 'small overhead bit stream.'" Nortel contends that the term "appended" more accurately describes the addition of FEC bits to the existing data signal in this context than the term "added." Ciena argues that the term encoding has a well understood meaning in the art, which is "adding coding bits."

The specification of the '176 patent indicates that: "Optionally, remodulators 30 include forward error correction (FEC) encoders 45. The addition of forward error correction to a wavelength division multiplexing optical communication system advantageously decreases the bit error rate by adding redundancy, e.g., coding bits, to the individual optical channels which comprise the [wavelength division multiplexing] signal." Col. 6:26-32. This language from the specification indicates that the "encoding" performed by encoders refers to adding coding bits. Although this example appears in a preferred embodiment, the term "append" or "appending" is not found anywhere in the '176 patent. Furthermore, the term "appending" potentially introduces unnecessary ambiguity to the claim term. The parties do not dispute that the addition of the bits required by the claim is not location specific. However, the word "append" tends to connote location, specifically adding to the posterior portion of that which is being appended. Accordingly, the Court construes the terms respectively as "adding coding bits; components for adding coding bits; configured to add coding bits; having coding bits added."

Source information; destination information; channel identification information

The Court adopts Ciena's proposed construction and construes the terms as "information identifying the source, destination, or channel." Nortel argues that the terms should be construed as "bits included in an appended bit stream that identify the source, destination, or channel." Nortel claims that the specification of the '176 patent "expressly explains that source, destination, and channel identification information are bits appended to an existing data frame through an overhead bit stream." Nortel cites Column 6, Lines 47 through 52 of the specification, which state:

> Advantageously, forward error correction in the [wavelength division multiplexing] optical system of the present invention enables a "channel trace" function that encodes the channel ID, source, and destination into a small overhead bit stream

> which would permit the remodulating channel selector to respond only to an incoming signal with the proper addressing.

Nortel argues that this excerpt from the specification supports its proposed construction by indicating that the identification, source, and destination information are bits that are added to the existing data by appending an "overhead bit stream." Ciena argues that the terms do not require construction, and alternatively that the term should be construed as "information identifying the source, destination, or channel."

The language of claim one states "transmitting a plurality of signals . . . each of said plurality of optical signals carrying data associated with a respective one of said plurality of encoded information streams and source information associated with a respective one of said plurality of optical channels." Col. 10:54-64. The claim language indicates that each optical signal carries source information related to one of the optical channels. Neither this claim language nor any other claim in the patent indicates that the source, destination, or channel identification information is added to an optical signal in the form of "bits included in an appended bit stream." Furthermore, the language from the specification cited by Nortel describes a preferred embodiment of the invention. "Although the written description may aid in the proper construction of a claim term, limitations, examples, or embodiments appearing only there may not be read into the claim." *Kraft Foods Inc. v. Int'l Trading Co.*, 203 F.3d 1362, 1366 (Fed. Cir. 2000). Accordingly, the Court does not read the preferred embodiment into the claim and construes the terms as "information identifying the source, destination, or channel."

THE '115 PATENT

The '115 patent discloses an optical network communication system in which multiple

network elements found along the network path exchange information over a service channel for the purposes of monitoring and controlling the system. The network communication system uses node control processors that are associated with each element of the network and transmit identification and status information to other node control processors within the network. These communications between the node control processors allow the network to take automatic corrective action in response to a fault or a change in operational parameters.

Monitoring a first optical component; modulating a second optical component

The Court adopts Nortel's proposed construction and construes the terms as "the activities of 'monitoring a first optical component' and 'modulating a second optical signal' occur 'at the location of the first optical component.'" Ciena argues that the Court does not need to construe the terms "monitoring a first optical component" and "modulating a second optical component" "because the meaning of each term is already clear and does not require any interpretation." Ciena contends that these terms are not terms of art and that their plain meaning controls. Ciena cites *Hoganas AB v. Dresser Industries, Inc.,* 9 F.3d 948, 950 (Fed. Cir. 1993), arguing that Nortel's construction should be rejected because "[i]t is improper . . . to add 'extraneous' limitations to a claim, that is, limitations added 'wholly apart from any need to interpret what the patentee meant by particular words or phrases in the claims."

This language from *Hoganas* is not particularly applicable to the basis for Nortel's proposed construction. In *Hoganas*, the Federal Circuit indicated that the district court erred by adding a size limitation to a term when the basis of the proper limitation only related to the shape of the element and not its size. *See id.* at 950-51. The district court added an extraneous limitation without any apparent support from the claim language or the specification. *See id.* Here, Nortel argues that the

claim language and specification support its construction. Nortel argues that the terms should be construed such that both the monitoring of the first optical component and the modulating of the second optical signal "occur 'at the location of the first optical component.'" Nortel first looks to independent claim 11 of the '115 patent, which states:

> A method of supervising an optical transmission system, comprising of:
>
> > monitoring a first optical component provided at a first location along an optical communication path, said optical communication path carrying a plurality of first optical signals, each of which being at a respective one of a plurality of first wavelengths;
> >
> > modulating a second optical signal in accordance with information associated with said first optical component, said second optical signal being a wavelength different than said plurality of first wavelengths;
> >
> > supplying said second optical signal to said optical communication path;
> >
> > detecting said second optical signal; and
> >
> > controlling a second optical component provided at a second location spaced from said first location along said optical communication path based on said information.

Nortel then turns to the language of the abstract and the summary of the '115 patent arguing that it further demonstrates the connection between the monitoring of the first optical component and the modulating of a second optical signal with the location of the first optical component. The abstract states:

> A first network element coupled to the optical communication path includes a first processor and a first optical component. The status of the first optical component being monitored by the first processor. The first processor generates a first electrical signal in accordance with the status of the first optical component. The first network element also includes a service channel transmitter coupled to a first processor and emits a second optical signal to the optical communication path at a second wavelength different than the first plurality of wavelengths in response to the first electrical signal. The second optical signal being modulated in accordance with the

second electrical signal.

See also Col. 2:16-28. Nortel argues that the language from the abstract and summary indicate that the first processor performs the monitoring of the first optical component and that the service channel performs the modulating of the second optical signal and both occur at the location of the first network element. Nortel contends this language demonstrates that the first optical component is part of the first network element and, therefore, the monitoring and modulating of the first optical component and second optical signal occur at the location of the first optical component. Nortel also argues that each embodiment is consistent with the description of the invention in the abstract and summary. *See* Cols. 2:58-65; 4:13-15; 3:63-65; 5:6-15.

The Court agrees with Nortel. "The person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification." *Phillips*, 415 F.3d at 1314. Statements found in the summary portion of the specification are not limited to describing a preferred embodiment of the invention, but more broadly describe the overall invention itself. *See Microsoft Corp. v. Multi-Tech Sys.* 357 F.3d 1340, 1348 (Fed. Cir. 2003). The language in the specification indicates that the monitoring of the first optical component and the modulating of the second optical signal occur at the location of the first optical component. Accordingly, the Court construes the term as "the activities of 'monitoring a first optical component' and 'modulating a second optical signal' occur 'at the location of the first optical component.'"

Detecting said second optical signal; controlling a second optical component

The Court adopts Nortel's proposed construction and construes the terms as "the activities of 'detecting a second optical signal' and 'controlling a second optical component' occur 'at the

location of the second optical component.'" Ciena also argues that the terms "detecting said second optical signal" and "controlling a second optical component" do not require construction because their meaning is clear and does not require any interpretation. Similarly, Ciena contends that the terms are not terms of art and, therefore, their plain meaning controls. Again, Ciena cites *Hoganas*, 9 F.3d at 950, arguing that Nortel's construction should be rejected because "[i]t is improper . . . to add 'extraneous' limitations to a claim, that is, limitations added 'wholly apart from any need to interpret what the patentee meant by particular words or phrases in the claims." For the reasons stated above, this language from *Hoganas* is not particularly applicable to the basis for Nortel's proposed construction.

Nortel argues that the activities of detecting a second optical signal and controlling a second optical component occur at the location of the second optical component. Nortel's argument is similar to the one it provided above with regard to the monitoring of the first optical component and the modulating of the second optical signal. Here, Nortel again looks to the abstract of the '115 patent, which states:

> [a] second network element is coupled to the optical communication path and includes a second processor, a second optical component coupled to the second processor and a service channel receiver coupled to the first processor and to the optical communication path. The receiver senses the second optical signal. The service channel receiver outputs a second electrical signal to the second processor in response to the second optical signal. The second processor controls the second optical component in response to the second electrical signal.

See also Col. 2:28-37. As with the monitoring and modulating terms, Nortel contends that the language from the abstract and summary indicate that the second processor performs the controlling of the second optical component and that the service channel receiver performs the detecting of the second optical signal and that both occur at the location of the second network element. Nortel

claims this language demonstrates that the second optical component is part of the second network element and, therefore, the controlling and detecting of the second optical component and second optical signal occur at the location of the second optical component.

Again, the Court agrees with Nortel. "The person of ordinary skill in the art is deemed to read the claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification." *Phillips*, 415 F.3d at 1314. As stated above, statements found in the summary portion of the specification are not limited to describing a preferred embodiment of the invention but more broadly describe the overall invention itself. *See Microsoft*, 357 F.3d at1348. The '115 patent specification indicates that both the detecting of a second optical signal and controlling of a second optical component occur at the location of the second optical component. Accordingly, the Court construes the term as "the activities of 'detecting a second optical signal' and 'controlling a second optical component' occur at the location of the second optical component."

Wavelength division multiplexed terminal

The Court construes the term as a "terminal at the end of a communication pathway having a transmitter and/or receiver for wavelength division multiplexing communications." Ciena initially argued that the term does not need to be construed. Alternatively, Ciena proposes that if the term is construed it should be construed as "terminal that can send and/or receive wavelength division multiplexed (WDM) communications." Nortel argues that the term should be construed as "an apparatus containing wavelength division multiplexed transmitters and receivers at an end of a wavelength division multiplexed optical communication path." During the *Markman* Hearing Ciena proposed a construction that read, "a terminal at an end of a communication pathway that can send

and/or receive [wavelength division multiplexing] communications." Nortel agrees with the "a terminal at an end of a communication pathway" language of the proposed construction but further suggests that the "can send and/or receive language be changed to "having a transmitter or a receiver." Nortel argues that the term is a structural element and should be construed in terms of structure and not capabilities.

Claim 5 of the '115 patent claims "An optical communication apparatus, comprising: a first wavelength division multiplexed terminal . . . ." The term is a structural element and should be construed in terms of structure. Accordingly, the Court agrees with Nortel and construes the term as "terminal at the end of a communication pathway having a transmitter and or receiver for wavelength division multiplexing communications."

THE '392 PATENT

The '392 patent discloses an optical network communication system similar to that disclosed in the '115 patent. The network system is designed so that elements of the network can communicate identification and status information throughout the network on a service channel, which allows the network to take corrective action when various faults occur within the network. However, the '392 patent is different from the '115 patent in that it discloses the use of the invention in conjunction with a wavelength division multiplexing communication system.

Configured to supply service channel optical signals

The Court agrees with Ciena's proposed construction and construes the term as "programmed to supply service channel optical signals." Ciena argues that the term should not be construed but offers its proposed construction in the alternative. Nortel argues that the term should be construed as "programmed to periodically supply service channel optical signals." Nortel argues that the

specification requires that each network element of the invention "periodically" transmits information to the other node control processors in the network. Nortel cites the abstract , the field of the Invention section, and the detailed description section of the '392 patent in support of its argument. *See e.g.*, Cols. 1:60-67; 7:11-19. However, a preferred embodiment of the invention indicates that the service channel optical signals are not always supplied periodically. Column 7, Lines 28 through 34 of the specification state,

> Assuming that a break occurs in fiber 68, [Service Channel Modem] 26 and 32 detect the break and set the fault bit in an LSP to signify that a break has occurred. The LSP is next passed from SCM 32 to SCM 36, and from SCM 26 to SCM 22. If additional network elements were included in the span, the LSPs would be successively passed from SCM to SCM down the span until the terminals were reached.

This excerpt from the specification indicates that signals for service are sometimes sent episodically sent when a problem arises as opposed to exclusively being sent periodically. Nortel's construction excludes this preferred embodiment. "The Court must always read the claims in view of the full specification. A claim construction that excludes a preferred embodiment . . . 'is rarely, if ever, correct.'" *SanDisk*, 415 F.3d at 1285 (citing and quoting *Vitronics,* 90 F.3d at 1582-83). Accordingly, the Court construes "configured to supply service channel optical signals" as "programmed to supply service channel optical signals."

THE '535 PATENT

The '535 patent discloses a method for monitoring messages on a wavelength division multiplexing network using a plurality of frames, each frame conforming to the synchronous optical network ("SONET") standard. The SONET standard defines a way of transmitting information on optical networks by breaking the information into small units called frames. A plurality of optical receiver and transmitter modules are found on each optical selector throughout the wavelength

division multiplexing network. The transmitter and receiver modules extract one byte from each of the plurality of frames. The successive bytes are then grouped as messages that are stored such that consecutive messages can be compared with, or checked against, a predetermined message.

Data frames; frames

The Court agrees with Ciena that these terms do not require construction. Nortel argues that the terms should be construed as "a frame corresponding to the synchronous optical network (SONET) or synchronous digital hierarchy (SDH) standard." Nortel contends that data frame should be limited such that it only applies to the SONET and SDH standards for transmitting data frames over optical communications networks. Nortel bases its argument on the fact that the SONET standard is mentioned in the title of the patent, the abstract, and the summary of the invention. Furthermore, Nortel argues that the only embodiments of the invention in the patent describe either a SONET or an SDH standard. However, the specification states,

> While the foregoing invention has been described in terms of the embodiments discussed above, numerous variations are possible. For example, the present invention is also applicable to synchronous digital hierarchy (SDH) formatted signals in addition to SONET signals discussed above. Accordingly, modifications and changes such as those suggested above, but not limited thereto, are considered to be within the scope of the following claims.

Col. 6:60-67. The specification clearly anticipates that other variations of the invention are possible and specifically addresses as an example that alternative formats of signals can be used with the invention.

Furthermore, the claims themselves do not contain such a limitation. Claim 1 of the patent does not mention either SONET or SDH standards. *See* Col. 7:2-20. Dependent claims 4 and 5 indicate that the inventor did not intend to limit the terms "data frames" and "frames" in claim 1.

Claim 4 reads, "A method in accordance with claim 1, wherein each of said first plurality of data frames and each of said second plurality of data frames are in a SONET format." Col. 7:36:38. Claim 5 reads, "A method in accordance with claim 1, wherein each of said first plurality of data frames and each of said second plurality of data frames are in an SDH format." Col. 7:39-41. "The presence of a dependent claim that adds a particular limitation gives rise to a presumption that the limitation in question is not present in the independent claim." *Phillips*, 415 F.3d at 1315. There is a presumption that independent claim 1 does not contain the limitation of either the SONET or the SDH format found in claims 4 and 5 respectively.

A person of ordinary skill in the art would understand the term "data frame" to have its ordinary meaning of "a frame of data" and the term "frames" as more than one frame. Accordingly, and for the reasons discussed above, the Court does not need to construe either term.

Extracting each of a . . . plurality of data segments from a respective one of a . . . plurality of data frames; extracting each of a plurality of data segments from a respective one of a plurality of data frames

The Court agrees with Ciena's proposed construction and construes the terms as "extracting a data segment from each of a plurality of data frames." Ciena argues that the terms should not be construed and offers its proposed construction in the alternative. Nortel argues that the terms should be construed as "extracting a data segment from each of a plurality of successive data frames." The significant difference between the parties' constructions is that Nortel contends that the data frames must be successive, meaning that no data frames are skipped during the extraction process. Nortel looks to Column 1, Lines 43 through 46 in support of its argument, which state, "Both the transmitter and receiver modules include byte extraction circuitry that extracts one byte, *e.g.*, the JO byte, from

each of the plurality of frames." However, this language from the specification states that the bytes are extracted from "each of the plurality of frames." There is nothing in this language or in the rest of the patent that requires the bytes to be extracted from successive frames within the plurality of frames. Accordingly, the Court construes the terms as "extracting a data segment from each of a plurality of data frames."

Extraction circuit outputting a plurality of data segments, each of which being selected from a respective one of said plurality of data frames; extraction circuit selecting each of a plurality of data segments from a respective one of said plurality of frames

The Court adopts Ciena's proposed construction and construes the terms as a "circuit extracting a data segment from each of a plurality of data frames." Ciena again argues that the terms do not need to be construed and offers its proposed construction in the alternative. Nortel argues that the terms should be construed as "circuit extracting a data segment from each of a plurality of successive data frames." Nortel presents the same arguments in support of its proposed construction here as it did in support of its construction of the "extracting each of a . . . plurality of data segments from a respective one of a . . . plurality of frames; extracting each of a plurality of data segments from a respective one of a plurality of data frames" terms discussed above. For the same reasons discussed above in reference to the terms "extracting each of a . . . plurality of data segments from a respective one of a . . . plurality of frames; extracting each of a plurality of data segments from a respective one of a plurality of data frames," the Court construes these terms as a "circuit extracting data segment from each of a plurality of data frames" without modifying the data frames with the word "successive."

THE '324 PATENT

The '324 patent discloses a time-division multiplexed digital transmission system. The invention discloses a system that "utilizes single stage multiplexing and demultiplexing of both synchronous and/or asynchronous bit streams from tributaries of widely differing bit rates," or speeds. Col. 1:6-8. This allows "direct access to individual synchronous channels, or to complete synchronous or asynchronous tributaries," without having to completely demultiplex the higher speed signal. Col. 1:9-11.

Means including bit stuffing means, for time-division multiplexing bit streams from a plurality of tributaries into a multiplexed bit stream

The parties do not dispute that this limitation should be construed as a means-plus-function limitation under 35 U.S.C. § 112, ¶ 6. The Court adopts Ciena's proposed construction and construes the function as "time-division multiplexing bit streams from a plurality of tributaries into a multiplexed bit stream, including inserting additional bits in each bit stream from the plurality of tributaries." Nortel argues that the function should be construed as "time-division multiplexing bit streams by byte interleaving from a plurality of tributaries into a multiplexed bit stream. Inserting additional bits in each bit stream from the plurality of tributaries." Nortel contends that the function should be limited such that the time-division multiplexing of bit streams only occurs on a byte interleaving bases, excluding either a frame or bit interleaving basis. In support of its construction, Nortel points to Column 7, Lines 13 through 14 of the specification, which state, "Fig. 2 illustrates that the bit streams from the various tributaries are interleaved on a word or byte basis." Nortel further looks to Column 5, Lines 35 through 49 of the specification, which discuss multiplexer [10], an undisputed part of the disclosed structure, and state that it "utilizes word [*i.e.* byte] interleaving

. . . ." Nortel argues that the specification disclaims coverage of both bit and frame interleaving. Nortel also points to Column 7, Lines 20 through 28 of the specification, which state:

> Thus the main reason for word [i.e., byte] interleaving rather than bit interleaving is that the resultant signal, when converted into a parallel bus is suitable for direct DS-0 or channel switching whereas a bit interleaved arrangement would require a complex protocol conversion to convert the signal into a word [*i.e.*, byte] interleaved structure before it could be applied to a conventional DS-0 switch.

"The Court must construe the function of a means-plus-function limitation to include the limitations contained in the claim language, and only those limitations. It is improper to narrow the scope of the function beyond the claim language." *Cardiac Pacemakers, Inc., v. St. Jude Med., Inc.*, 296 F.3d 1106, 1113 (Fed. Cir. 2002). The limitation that Nortel asks the Court to include in the function is found nowhere in the relevant claim language. Furthermore, the specification specifically states that "both bit interleaving and frame interleaving are also possible. However the former is not compatible with a *preferred* 8-bit wide bus structure . . . ." Col. 7:14-15 (emphasis added). The patentee did not disclaim the use of bit and frame interleaving, but disclosed them as alternative embodiments. "A claim construction that excludes a preferred embodiment . . . 'is rarely, if ever, correct.'" *SanDisk*, 415 F.3d at 1285 (citing and quoting *Vitronics,* 90 F.3d at 1582-83). Accordingly, the Court construes the function without a limitation that the time-division multiplexing must occur on a byte-by-byte basis.

The Court adopts Nortel's proposed construction and construes the corresponding structure as "multiplexing and bit-stuffing circuitry, for example: multiplexer 10; and bit stuffers 11, 12, 13, and 14, shown in Figure 2, and equivalents thereof." Ciena argues that the corresponding structure should be construed as "Multiplexer 10; bit stuffers 11, 12, 13 and 14, as shown in Figure 2, further illustrated in Figure 3, and described at 7:43-10:66, and equivalents." Ciena claims that the

multiplexer 10 alone performs the multiplexing function, and that only bit stuffers 11, 12, 13, and 14 perform the bit stuffing function. Ciena further argues that the terms "multiplexing circuitry" and "bit stuffing circuitry" do not appear anywhere in the specification and, therefore, cannot be corresponding structure.

The phrases "circuit arrangement for stuffing and multiplexing" and "circuitry for stuffing additional bits" are both found in the specification. Cols. 10:48-52; 3:25-30. Specifically, the specification states, "The multiplexer is characterized by circuitry for stuffing additional bits . . . . It is also characterized by circuitry for stuffing additional bits . . . ." Col. 3:25-30. With regard to the means for time-division multiplexing, Nortel contends that Ciena is unnecessarily limiting the multiplexing circuitry to a single stage multiplexer, embodied as multiplexer 10. Nortel argues that the single-stage multiplexer is only mentioned in the specification as an optional technique and is not required. In support of its argument, Nortel points to Column 3, Lines 44 through 45 of the specification, which state, "bit streams . . . can be demultiplexed or multiplexed to or from the tributary level in the same single stage." Under § 112 ¶ 6, courts should not incorporate structure from the written description that is not necessary to perform the claimed function. *Micro Chem., Inc., v. Great Plains Chem. Co., Inc.*, 194 F.3d 1250, 1258 (Fed. Cir. 1999). The specification does not require single stage multiplexing but rather states that it can be done. Accordingly, the Court does not limit the corresponding structure of the means for time-division multiplexing to multiplexer 10, but construes it as multiplexing circuitry.

Again, with regard to the means for bit stuffing, the specification states, "The multiplexer is characterized by circuitry for stuffing additional bits . . . . It is also characterized by circuitry for stuffing additional bits . . . ." Col. 3:25-30. The specification also illustrates an asynchronous DS-1

bit stuffer which is different from the bit stuffers described in Figure 2. *See* Col. 9:22-31. Under § 112 ¶ 6, when multiple embodiments in the specification correspond to the claimed function, a court should generally not limit the claim to exclude one such embodiments. *See Micro Chem.,* 194 F.3d 1258. Accordingly, the Court does not limit the corresponding structure of the means for bit stuffing to bit stuffers 11,12,13, and 14, as shown in Figure 2 and instead construes it as bit stuffing circuitry.

<u>*Means for time-division multiplexing said bit streams into a multiplexed bit stream, at least one of the bit streams being divided into frames, each frame having m channels each n bits long and also having at least one additional control bit*</u>

The parties do not dispute that this limitation should be construed as a means-plus-function limitation under 35 U.S.C. § 112, ¶ 6. The Court adopts Ciena's proposed construction and construes the function as "time-division multiplexing said bit streams into a multiplexed bit stream, at least one of the bit streams being divided into frames, each frame having m channels each n bits long and also having at least one additional bit used for synchronization and signaling control of the data frames." Nortel argues that the function should be construed as "time-division multiplexing the bit streams into a multiplexed byte interleaved bit stream." As it did with regard to the preceding term, Nortel contends that the function should include a limitation so that multiplexing only occurs on a byte interleaving basis. For the same reasons laid out above, the Court does not construe the function to include such a limitation. Furthermore, Nortel argues that the language "each frame having m channels each n bits long and also having at least one additional bit . . . ." refers to the function extrinsic to the imputed means. Nortel contends that this clause describes incoming bit streams and not the means for time-division multiplexing.

The clause that Nortel claims should be excluded describes the bit streams that are being multiplexed. Furthermore, it is improper to broaden the scope of a claimed function by ignoring clear limitations in the claim language. *Cardiac Pacemakers,* 296 F.3d at 1113. The language Nortel opposes is expressly included in the claim language and, therefore, should be included as a limitation on the claim.

The Court adopts Nortel's proposed construction and construes the corresponding structure as "multiplexing circuitry, for example: multiplexer 10 shown in Figure 2 and equivalents thereof." Ciena argues that the corresponding structure should be construed as "multiplexer 10, as shown in Figure 2 and equivalents." Again, Ciena contends that the multiplexer 10 alone performs the multiplexing function. For the same reasons discussed in regard to the previous term, the Court disagrees with Ciena and construes the corresponding structure without such a limited scope.

Means for stuffing additional bits in said one bit stream to increase the resultant number of bits from the one stuffed frame in the multiplexed bit stream to kn, where k is a positive integer

The parties do not dispute that this limitation should be construed as a means-plus-function limitation under 35 U.S.C. § 112, ¶ 6. The Court and the parties agree that the function should be construed as "stuffing additional bits in said one bit stream to increase the resultant number of bits from the one stuffed frame in the multiplexed bit stream to kn, where k is a positive integer."

The Court adopts Nortel's proposed construction and construes the corresponding structure as "bits stuffing circuitry, for example: bit stuffers 11, 12, 13, and 14 in Figure 2 and equivalents thereof." Ciena argues that the corresponding structure should be construed as "bit stuffers 11,12,13, and 14, as shown in Figure 2, further illustrated in Figure 3, and described at 7:43-10:66, and equivalents." Again, Ciena claims that only bit stuffers 11, 12, 13, and 14 perform the bit stuffing

function. For the same reasons discussed above, the Court disagrees with Ciena and construes the corresponding structure without such a limited scope.

Means for stuffing additional bits in each of the other bit streams to increase the resultant number of bits from each of the other stuffed frames in the multiplexed bit stream to jkn, where j is a positive integer for each of the other stuffed frames

The parties do not dispute that this limitation should be construed as a means-plus-function limitation under 35 U.S.C. § 112, ¶ 6. The Court and the parties agree that the function should be construed as "stuffing additional bits in each of the other bit streams to increase the resultant number of bits from each of the other stuffed frames in the multiplexed bit stream to jkn, where j is a positive integer for each of the other stuffed frames."

The Court adopts Nortel's proposed construction and construes the corresponding structure as "bit stuffing circuitry for example: bit stuffers 11, 12, 13, and 14 in Figure 2 and equivalents thereof." Ciena argues that the corresponding structure should be construed as "bit stuffers 11,12, 13 and 14, as shown in Figure 2, further illustrated in Figure 3, and described at 7:43-10:66, and equivalents." In support of its construction, Ciena presents all the same arguments it did with regard to the previous terms. Again, for the same reasons discussed above, the Court construes the corresponding structure without such a limited scope.

THE '363 PATENT

The '363 patent discloses a path oriented routing system and a method for packet switching networks with end-to-end internal protocols. The invention "allows the same switch pairs to communicate over multiple paths (for better network throughput), while maintaining knowledge of user connections at the network's endpoints only." Col. 1:32-35. The method allows existing traffic

to maintain its existing paths while newer traffic can be assigned to the new shortest path. This helps minimizes packet disordering and creates stable multiple path routing.

Destination switch

The Court adopts Ciena's proposed construction and construes the term as "packet switch for which a packet is destined." Nortel argues that the term should be construed as "the last path-oriented switch along the preferred path to which a packet forwarded by the originating switch is destined." Nortel contends that the claims of the '363 patent require that the "destination switch" is the last path-oriented switch along a path, "regardless of whether or not the last path-oriented switch forwards the packet to another non-path-oriented switch." Nortel's position is based on its determination that the network is made up of both path-oriented and non-path-oriented switches. Nortel points to the preamble of claim 1, which states,

> A path oriented routing method for packet switching networks, wherein said network is comprised of a plurality of interconnected packet switches wherein at any given period of time each said packet switch can be functioning as a destination switch, an originating switch, a tandem switch, or any combination of the preceding, . . .

arguing that the preamble's use of the word "comprised" indicates that the path oriented routing method includes non-path-oriented switches. Col. 5:37-43.

Ciena contends that the Nortel has coined the terms "path-oriented switch" and "non-path-oriented-switch." As the preamble to claim 1 indicates, the patent discloses a path-oriented routing method for "packet switches." *See* Col. 5:37-39. The patent discusses the method's use of packet switches in significant detail. *See* Cols. 6:10-13; 6:10-13; 6:27-29; 1:30-31. However, the term "path-oriented switch" does not appear anywhere in the patent. The Court rejects Nortel's use of the term "path-oriented switch" because its use is not supported by the intrinsic record. *See Phillips*, 415

F.3d at 1315. Furthermore, the language of claim 1 indicates that any packet switch in the network can function as a destination switch at any given time and does not support the distinction between path-oriented and non-path-oriented switches. *See* Col. 5:37-43.

Ciena argues that the clear language of the specification supports its construction. In support of its argument, Ciena cites Column 2, Lines 8 through 10 that state, "the preferred path identifier to use to send messages to it destined ultimately for the destination packet switch," and Column 2, Lines 15 through 18 that state, "a path identifier being associated with each packet at the source packet switch and carried by the packet as it traverses through the network to the destination switch." The Court agrees with Ciena and construes the term "destination switch" as a "packet switch for which a packet is destined."

Tandem switch

The Court adopts Ciena's proposed construction and construes the term as "an intermediate switch other than the originating and destination switches." Nortel argues that the term should be construed as "any path-oriented switch that is intermediate to a destination switch and an originating switch on a path." Nortel presents the same arguments with regard to "path-oriented switch" as it did above in its proposed construction of "destination switch." For the same reasons discussed above, the term "path-oriented switch" should not be included in the construction of the term "tandem switch." Accordingly, the Court adopts Ciena's proposed construction of the term.

Adjacent neighbouring switches

The Court modifies Ciena's proposed construction and construes the term as "switches coupled with another switch." Nortel argues that the term should be construed as "the first path-oriented switches encountered along each transmission path from a given switch." Again, for the

reasons discussed above the Court rejects Nortel's inclusion of the "path-oriented switch" in the definition of the term.

Ciena contends that the term should be construed as "switches directly connected to another switch." Ciena argues that the claims and the specification support its argument that the switches must be directly connected to one another. *See* Cols. 3:2-6 ("This information is calculated at switch C and is broadcast to all switches that are directly connected to switch C (*i.e.* to switches A, B, D, and E in this example)"); 3:21-23; 4:14-17. Nortel argues that the term "directly connected" does not appear in the claim language and is not required by the specification. However, the parties do not dispute that each "adjacent neighbouring switch" must be able to communicate with the switch connected to it as displayed in Figure 1. The real disagreement between the parties involves Nortel's concern that the use of the words "directly connected" will create the opportunity for Ciena to later argue that a repeater or some other device placed between two switches will prevent them from being "directly connected." Therefore, the Court construes the term such that the switches are "coupled with" another switch.

Originating switch

The Court adopts Ciena's proposed construction and construes the term as "the first packet switch to forward a packet destined for the destination switch." Nortel argues that the term should be construed as "the first path-oriented packet switch along the preferred path that serves to forward a packet destined for the destination switch." For the same reasons discussed above, the Court rejects Nortel's use of the term "path-oriented packet switch." Accordingly, the Court construes the term without including "path-oriented."

Packet switch

The Court adopts Ciena's proposed construction and construes the term as "a routing device that forwards packets." Nortel argues that the term should be construed as "a path-oriented routing device that forwards packets." For the same reasons discussed above, the Court rejects Nortel's use of the term "path-oriented." Accordingly, the Court construes the term without including "path-oriented."

Shortest path

The Court modifies Ciena's construction and construes the term as "path through the network having the shortest distance (distance being a function of the time delay incurred by a packet moving from one switch to another, sometimes referred to as 'cost' or 'delay')." The parties do not dispute that the term "shortest path" is not limited to physical distance. However, the parties disagree as to how distance should be explained in the definition of the term. Nortel argues that the term should be construed as "the best path according to established criteria (such as, for example, least cost, least delay and least traffic)." Nortel relies on the declaration of its expert Dr. Enslow for this definition.

In discussing Figure 5d, which depicts the distance of each trunk to the next switch, the specification states,

> Note that the use of the term "distance" in the present context does not mean physical distance but rather is a term well known in this art that is a function of the time delay incurred by a packet moving from one switch to another. A normalized value of distance is typically used (ranging, for example, from 0 to 2,048 for a single trunk). This concept is also sometimes referred to as "cost" or "delay."

Col. 3:63-4:2. "Words of a claim 'are generally given their ordinary and customary meaning.'" *Phillips*, 415 at 1312 (citing *Vitronics,* 90 F.3d at 1582). "[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in

question at the time of the invention, ..." *Id*. at 1313. In determining the meaning of a claim term as understood by persons of skill in the art, courts should look to "'the words of the claims themselves, the remainder of the specification, the prosecution history, and extrinsic evidence concerning relevant scientific principles, the meaning of technical terms and the state of the art.'" *Phillips*, 415 F.3d at 1314 (citing *Innova/ Pure Water,* 381 F.3d at 1116).

Phillips instructs the Court to first look to the specification to determine the ordinary and customary meaning of a claim term. Here, the specification indicates the definition of the term distance, a term which is integral to the understanding of the claim term "shortest path," as it was understood within the art at the time of the invention. In this situation, it is not necessary to look to extrinsic evidence such as an expert's declaration. Accordingly, the Court defines "shortest path" using the word distance and explains the definition of distance as the specification indicates it would have been understood by a person of skill in the art at the time of the invention.

THE '142 PATENT

The '142 patent discloses a mechanism for sending digital data in Asynchronous Transfer Mode cells "over multiple slower transmission links." Col. 1:10-11. The invention describes a method of transparently inverse multiplexing a series of Asynchronous Transfer Mode cells over one or more transmission links of slower speeds. Inverse multiplexing occurs when digital data in Asynchronous Transfer Mode cells is sent to a destination node over more than one transmission link in a specific round robin order. The invention also provides a method for cell stuffing to accommodate non-synchronized links.

Inverse multiplexing digital data over a connection consisting of a plurality of transmission links

The Court agrees with Nortel that the term does not require construction. Ciena argues that the term should be construed as "sending digital data over multiple transmission links in round robin order." Ciena contends that, although the term is found in the preamble to claim 1, it limits the claim and should be construed. Ciena cites *Catalina Marketing International, Inc. v. Coolsavings.com, Inc.*, arguing that the term limits the claim because the preamble gives life, meaning and validity to the body of claim 1. *See* 289 F.3d 801, 808 (Fed. Cir. 2002). Ciena cites three examples of terms found in the preamble that also appear in the body of claim 1 contending, therefore, that limitations in the body of the claim derive antecedent basis from the preamble. Finally, in support of its construction, Ciena cites an excerpt from the specification of the '142 patent. The specification states,

> At the transmitting node, an AIM 1 - takes a series of [Asynchronous Transfer Mode] cells from an [Asynchronous Transfer Mode] layer device. It spreads [Asynchronous Transfer Mode] cells and transmits each cell over each of N transmission links, N being a positive integer. The order of transmission is in round robin fashion. This process is called an inverse multiplexing.

Col. 5:20-25.

It is well settled that "if the body of the claim sets out the complete invention, and the preamble is not necessary to give life, meaning and vitality to the claim, then the preamble is of no significance to claim construction . . . ." *Altris, Inc. v. Symantec Corp.*, 318 F.3d 1363, 1371 (Fed. Cir. 2003); *see also Catalina Mktg. Int'l*, 289 F.3d at 808-09 (holding "a preamble generally is not limiting when the claim body describes a structurally complete invention such that deletion of the preamble phrase does not affect the structure or steps of the claimed invention."). The claim body

of claim 1 provides a complete description of the claimed method. The preamble does not give life, meaning and vitality to the claim. Accordingly, the Court does not need to construe the term in the preamble.

Cell stuff information

The Court agrees with Nortel and construes the term as "information relating to cell stuffing." Ciena argues that the term should be construed as "information indicating the location of cells that enable the receiving node to remove them." Ciena contends that its construction of "cell stuff information" reflects the ordinary meaning of the term as evidenced by the specification. In support of its argument, Ciena points to Column 10, Lines 35 through 37 of the specification that state, "[a]ny cell can be used for stuffing as long as the location is indicated so that the receiving node can remove it."

Claim 3 of the patent is an independent claim that discloses a method comprising, among other things, "transmitting from the first node the series of [Asynchronous Transfer Mode] data cells in the round robin order, the first node inserting at least one inverse multiplexing control cell that contains cell stuff information into each frame." Claim 4, a dependent claim of claim 3 reads, "The method of claim 3, wherein the cell stuff information includes stuff code indicating the location of stuff cells inserted in a respective frame." If the Court were to adopt Ciena's construction, claim 4 would effectively read, "The method of claim 3, wherein the information indicating the location of cells that enable the receiving node to remove them includes stuff code indicating the location of stuff cells inserted in a respective frame." The Federal Circuit has held "[t]he difference in meaning and scope between claims is presumed to be significant 'to the extent that the absence of such difference in meaning and scope would make a claim superfluous.'" *Versa Corp. v. Ag-Bag Int'l*

Ltd., 392 F.3d 1325, 1329-30 (Fed. Cir. 2004)(citing *Tandon Corp. v. U.S. Int'l Trade Com.*, 831 F.3d 1017, 1023 (Fed. Cir. 1987)). Ciena's construction makes the location limitation in claim 4 redundant and superfluous and, therefore, the Court rejects it. Furthermore, the excerpt from the specification is described in the context of one embodiment of the invention and does not support Ciena's construction of the term. The term "cell stuff information" should retain its ordinary meaning. Accordingly, the Court construes the term as "information relating to cell stuffing."

THE '760 PATENT

The '760 patent discloses a method for configuring SONET transport nodes that allow the "transparent transport" of lower bit rate digital signals over a high bit rate span of a telecommunication system. The patent defines transparent transport as "the ability to provide continuity of all payloads and associated overhead bytes necessary to maintain a lower bit rate linear or ring system through a higher bit rate midsection." Col. 1:42-45. The invention allows the lower bit rate linear or ring system to operate as if it were directly connected without being connected by a higher bit rate midsection.

No change to the provisioning of any of said trib systems

The Court agrees with Nortel that this term does not require construction. Ciena argues that the term should be construed as "not making any changes to the equipment or settings of any of the trib systems." Ciena cites *Catalina Marketing International* arguing that the preamble limits the claimed invention because it "recites essential structure or steps" or "is necessary to give life, meaning, and vitality to the claim." 289 F.3d at 808. Ciena contends that the term "no change to the provisioning of any of said trib systems" provides antecedent basis for several limitations in the body of the claim.

It is well settled that "if the body of the claim sets out the complete invention, and the preamble is not necessary to give life, meaning and vitality to the claim, then the preamble is of no significance to claim construction . . . ." *Altris*, 318 F.3d at 1371 (Fed. Cir. 2003); *see also Catalina Mktg. Int'l*, 289 F.3d at 808-09. There is no mention in the body of claim 24 of changing the provisions of the tributary system referenced in the preamble. Furthermore, the body of claim 24 sets out the complete invention. The preamble does not give life, meaning and vitality to the claim. Accordingly, it is not necessary for the Court to construe the term.

Distinctly manipulating the bytes of each said trib OH

The Court and the parties agree that the term should be construed as "manipulating in a distinct manner each of the overhead bytes, or a group of bytes, of each of the tributary signals."

Distinctly manipulating the bytes of said supercarrier OH

The Court and the parties agree that the term should be construed as "manipulating in a distinct manner each of the overhead bytes, or a group of bytes, of each of the tributary signals."

THE '519 PATENT

The '519 patent discloses a method for carrying data frame traffic from a local area network over a wide area network transported on a long distance high capacity synchronous digital network. The frame based data communication network is interfaced with the synchronous digital network using multiple frame based data port cards incorporated into multiple synchronous multiplexers. The invention enables frame based data to be directly incorporated into a synchronous virtual container without encapsulation in an intermediate protocol.

Rate adapting said Ethernet frame based data by adapting an Ethernet data frame to at least one bit stream, each bit stream having a data rate which can be multiplexed into a synchronous digital network virtual container

The Court modifies both Ciena's and Nortel's proposed constructions and construes the term as "converting Ethernet frame based data and the data rate into one or more bit streams, each bit stream has a data rate which can be multiplexed into a synchronous digital network virtual container, the bit stream is not encapsulated in an intermediate format." Ciena argues that the term should be construed as "converting the data rate of the data in Ethernet frames to a data rate of at least on bit stream by dividing the data in Ethernet frames among one or more bit streams, where each bit stream has a data rate which can be multiplexed into a synchronous digital network virtual container. The bit stream is not encapsulated in an intermediate format." Nortel argues that the term should be construed as "converting Ethernet frame based data into one or more bit streams, each bit stream has a data rate which can be multiplexed into a synchronous digital network virtual container." The parties mainly dispute whether the Ethernet frame based data or the data rate of the data in the Ethernet frames is being converted or adapted.

Ciena argues that the data rate in the Ethernet frames is being adapted. Ciena contends that the presence of the words "rate adapting said Ethernet frame based data" at the beginning of the claim term requires such a conclusion. Ciena also points to Column 7, Lines 60 through 63 of the specification, which state, "Rate adaption means 203 comprises a plurality of multiple channels each adapting an IEEE standard 802.3 rate data frame channel to a 2 M/bits/s, 50 Mbits/s or 100 Mbits/s bitstream channel" arguing that it proves that the whole point of the invention is rate adapting the data received at a higher rate into one or more bit streams at a lower rate. Furthermore, Ciena argues

that a Response to an Examiner's Office Action found in the file history of the patent supports its construction. The Response states, "The invention provides means to adapt the Ethernet data frames to a rate which matches a rate which can be multiplexed into a virtual container and maps each Ethernet data frame into one or more virtual containers without any further encapsulation in intermediate protocols." Response to Office Action for '519 Patent dated July 17, 2001, at 9.

The Court proposed the first part of its construction to the parties during the *Markman* Hearing. This portion of the proposed construction reads, "converting Ethernet frame based data and the data rate into one or more bit streams, each bit stream has a data rate which can be multiplexed into a synchronous digital network virtual container." Ciena's only objection to the proposed construction was the fact that the construction did not address the encapsulation issue discussed below. Therefore, Ciena agreed that the Ethernet framed based data is also converted under the claim language.

However, Nortel still argues that only the Ethernet framed based data is being adapted. Nortel contends that the claim language requires its construction. Nortel points to the claim language, which reads, "rate adapting said Ethernet frame based data by adapting an Ethernet data frame to at least one bit stream," arguing that the claim does not limit the Ethernet rate adaption to rate adaption of a frame because the claim language does not contain the word "rate" before the second occurrence of the word "adapting" in the quoted excerpt. Nortel also argues that its construction is supported by the specification, which states, "Rate adaption means 203 comprises a plurality of through channels for adapting IEEE standard 802.3 data frames into bitstreams . . . ." Col. 7:57-60. Nortel further cites Column 7, Lines 60 through 63 of the specification that state, "Rate adaption means 203 comprises a plurality of multiple channels each adapting an IEEE standard

802.3 rate data frame channel to a . . . bitstream channel."

The claim language and the specification indicate that both the data rate and the Ethernet frame based data are converted under claims 1, 23, and 24. The claim language starts off with the words "rate adapting." These words indicate that the data rate is being converted by this step of the method. This claim language cannot be ignored in construing the term. The parties and the Court agree that the Ethernet frame based data is converted under the claim. Accordingly, the Court construes the term such that both the data rate and the Ethernet frame based data are converted.

Ciena further contends that the term should be construed such that the bit stream is not encapsulated in an intermediate format. Nortel argues that this limitation is improper because: "(1) the inventor did not clearly disclaim intermediate encapsulation in the asserted claims; (2) intermediate encapsulation is not a part of the asserted claims; and (3) the specification's discussion of intermediate encapsulation relates to the mapping step, not the rate adapting step." Nortel cites *Home Diagnostics,* 381 F.3d at 1358, arguing that nothing in the specification or file history amounts to a clear and unambiguous disavowal of "intermediate encapsulation." Nortel contends that a specific absence of intermediate encapsulation in the specification is only a preferred embodiment and not a required limitation. *See* Cols. 3:18-21; 2:52-3:2. Furthermore, Nortel argues that claims 1, 23, and 24 leave open the possibility that the Ethernet frame based data can pass through an intermediate protocol and that the limitation on intermediate encapsulation only applies to other claims that state that the Ethernet frame based data is "mapped directly" to a synchronous digital network. Finally, Nortel argues that there are two steps to the method asserted in claims 1, 23, and 24 and that the absence of intermediate encapsulation only applies to the "inputting" step, while the claim language at issue deals with the "adapting" step. Nortel looks to a continuation patent of the

‘519 patent to support this argument.

Ciena argues that no language in claim 1 indicates that the bit stream is encapsulated in an intermediate format but rather indicates that the rate adapted bit stream is passed along the synchronous digital network. Ciena cites the abstract of the patent, which states, “frame based data is incorporated directly into a synchronous virtual container without encapsulation in an intermediate protocol” and several excerpts from the specification arguing that the patent prohibits the bit stream from being encapsulated in an intermediate format. Specifically, Ciena points to an excerpt from the summary of the invention that states, “Another object of the present invention is to incorporate frame based data directly into a synchronous digital hierarchy payload, without encapsulation in an [Asynchronous Transfer Mode] cell or other intermediate carrier.” Col. 2:62-65; *see also* 7:16-21.

The abstract and the quoted section of the specification refer to the invention as a whole and not just a preferred embodiment. When the specification reveals an intentional disclaimer or disavowal, “the inventor has dictated the correct claim scope and, and the inventor’s intention, as expressed in the specification, is regarded as dispositive.” *Phillips*, 415 F.3d at 1316. Furthermore, there is not compelling intrinsic evidence from the ‘519 patent that the limitation only applies to claims that involve “mapping” and not claims such as 1, 23, and 24 that relate to adapting. Accordingly, the Court construes the term to include the encapsulation limitation.

Synchronous digital network virtual container

The Court does not adopt either party’s proposed construction and construes the term as “an information payload that can be transported across a digital network that uses time-division multiplexing such as SDH or SONET.” Ciena argues that the term should be construed as “SONET or SDH virtual container.” Ciena contends that the specification and prosecution history indicate

that a person of ordinary skill in the art would understand synchronous digital network virtual container as a virtual container for only SDH or SONET networks. In support of its construction, Ciena points to the abstract and specification of the patent. The abstract states, "Each port card comprises a conventional frame based data port, a frame switch, a rate adapter means and a mapping means for mapping data frames into a plurality of SDH virtual containers." *See also* Cols. 7:49-51; 7:63-8:2; 10:53-54. Ciena argues that the specification only references SDH virtual containers. However, Ciena concedes that the file history supports a definition of "virtual container" that also includes the SONET standard.

Nortel argues that the term should be construed as "a data channel that can be combined with other such data channels and transported across a synchronous digital network." Nortel contends that the term should not be construed to limit "synchronous digital network" to only the SONET and SDH standards. The parties agree that the term "synchronous digital network" should be construed as a "digital network that uses time-division multiplexing such as SDH or SONET." Nortel argues that this construction of "synchronous digital network" indicates that SONET and SDH are examples of synchronous digital networks but does not limit the term to only SONET and SDH networks. Nortel contends that to construe "synchronous digital network virtual container" as limited to only SONET and SDH data channels would be inconsistent with the agreed construction of "synchronous digital network." In further support of its argument that the term should not be limited to only the SDH and SONET data channel, Nortel points to Column 7, Lines 11 through 14 of the specification, which state, "A set of STM frames are assembled to contain a plurality of virtual containers which are carried as an STM payload as illustrated in FIG. 4 herein."

The portion of the specification cited by Nortel indicates that a virtual container is carried

as an information payload. Furthermore, the specification does not limit virtual container to a data channel such as SDH or SONET and to construe the term with such a limitation would be inconsistent with the parties agreed construction of "synchronous digital network." Accordingly, the Court construes the term "synchronous digital network virtual container" as "an information payload that can be transported across a digital network that uses time-division multiplexing such as SDH or SONET."

Ethernet

The Court agrees with Ciena and construes the term as "data communications protocol available in 10 Mbits/s, 100 Mbits/s and 1 GigaBits/s versions." Nortel argues that the term should be construed as "a network protocol defined by the IEEE 802.3 standard." Nortel relies on several dictionary definitions for its construction and further contends that its construction is consistent with how the term is used in the specification. Arguing that the specification supports its construction, Nortel cites Column 2, Lines 8 through 13 of the specification, which discuss the different protocols used in the data communications industry and state that the industry "developed using a completely different set of interfaces and protocols, for example carrier sense multiple access collision detection CSMA/CD systems, subject of IEEE standard 802.3, and Ethernet which is available in 10 M/Bits/s, 100 M/Bits/s and 1 GigaBits/s versions." However, this excerpt from the specification draws a distinction between the CSMA/CD protocol, which it states is subject to IEEE standard 802.3, and Ethernet, which it does not connect to the IEEE standard.

Furthermore, Nortel cites Column 7, Lines 52 through 54 of the specification, which state, "Ethernet ports operating at 10 MBits/s; and 100 MBits/s in accordance with IEEE standard 802.3" arguing that it supports Nortel's definition of "Ethernet." However, the fact that the ports are in

accordance with the IEEE standard does not indicate that the patentee meant to define "Ethernet" as "a network protocol defined by the IEEE 802.3 standard."

Ciena's construction is supported by the specification. The specification indicates that Ethernet is a protocol used in the data communications industry, as opposed to the telecommunications industry. *See* Col. 1:66-2:16. The specification also references bit rates of 10 M/Bits/s, 100 M/Bits/s and 1 GigaBits/s in reference to the Ethernet protocol. *See* Col. 2:12-13. "[T]he specification 'is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.'" *Phillips*, 415 F.3d at 1315. Accordingly, the Court construes the term in accordance with the specification.

CONCLUSION

For the foregoing reasons, the Court interprets the claim language in this case in the manner set forth above. For ease of reference, the Court's claim interpretations are set forth in a table as Appendix B. The claims with the disputed terms in bold are set forth in Appendix A.

So ORDERED and SIGNED this 25th day of April, 2006.

LEONARD DAVIS
UNITED STATES DISTRICT JUDGE

APPENDIX A

U.S. PATENT NO. 5,715,076

1. A **remodulating channel selector** for a wavelength division multiplexed optical communication system comprising:
an **optical input port** configured to receive a wavelength division multiplexed optical communication signal from a wavelength division multiplexed optical communication system;
an optical channel selector optically communicating with the optical input port for optically selecting a single optical channel from the wavelength division multiplexed optical communication signal received from the **optical input port**;

an **optical channel selector** optically communicating with the optical input port for optically selecting a single optical channel from the wavelength division multiplexed optical communication signal received from the optical input port;
an optical-to-electrical converter optically communicating with the **optical channel selector** for receiving the selected optical channel from the **optical channel selector** and outputting an electrical signal corresponding to information from the selected optical channel;
an optical signal emitter for creating an optical signal for outputting to a **remodulating channel selector output port**;
modulator means for imparting information from the selected optical channel to the optical signal created by the optical signal emitter, the modulator means communicating with the electrical signal created by the optical-to-electrical converter and communicating with the optical signal emitter.

2. A **remodulating channel selector** as recited in claim 1 wherein the **optical channel selector** comprises a Bragg grating.

3. A **remodulating channel selector** as recited in claim 1 wherein the optical signal emitter is a laser.

5. A **remodulating channel selector** as recited in claim 1 further comprising clock and data recovery elements positioned between the optical-to-electrical converter and the modulating means.

6. A **remodulating channel selector** as recited in claim 1 wherein the modulating means directly modulates the optical signal emitter.

7. A **remodulating channel selector** as recited in claim 1 wherein the modulating means is an external modulator.

8. A **remodulating channel selector** as recited in claim 1 further comprising a forward error correction decoder positioned between the optical-to -electrical converter and the modulating means.

9. A **remodulating channel selector** as recited in claim 1 wherein the wavelength of the optical signal emitted by the optical signal emitter is the same as one of the channel wavelengths which comprise a wavelength division multiplexed optical signal input to the **optical input port**.

10. A **remodulating channel selector** as recited in claim 1 wherein the wavelength of the optical signal emitted by the optical signal emitter is different from any of the channel wavelengths which comprise a wavelength division multiplexed optical signal input to the optical input port.

11. A **remodulating channel selector** as recited in claim 1 where in the wavelength of the optical signal emitted by the optical signal emitter is the same as the wavelength of the optical

channel selected by the **optical channel selector**.

U.S. PATENT NO. 6,618,176

1. A communication method comprising the steps of:
receiving a plurality of information streams; encoding each of said plurality of information streams in accordance with a forward error correction code; and
transmitting a plurality of optical signals, each of which corresponding to a respective one of a plurality of optical channels, each of said plurality of optical signals being at a respective one of a plurality of wavelengths, selected ones of said plurality of wavelengths being spaced from one another by not more than 1.6 nm, each of said plurality of optical signals carrying data associated with a respective one of said plurality of **encoded** information streams and **source information** associated with a respective one of said plurality of optical channels.

7. A communication method in accordance with claim 1, wherein said each of said plurality of optical signals further carries **destination information** associated with a corresponding one oft said plurality of optical channels.

8. An optical communication device, comprising:
a plurality of photodetectors, each being configured to sense a respective one of a first plurality of optical signals and output a corresponding one of a first plurality of electrical signals in response thereto;
a plurality of **encoders** being configured to receive a respective one of said plurality of electrical signals, each of said plurality of **encoders** being **configured to encode** data carried by each of said first plurality of electrical signals in accordance with a forward error correction code and output a respective one of a second plurality of electrical signals; and
a plurality of optical emitters, each configured to output a respective one of a second plurality of optical signals in accordance with a respective one of said plurality of **encoded** data streams, each of said second plurality of optical signals being at a respective one of a plurality of wavelengths, selected ones of said plurality of wavelengths being spaced from one another by not more than 1.6 nm, each of said second plurality of optical signal carrying **source information** associated with a corresponding one of said second plurality of optical signals.

13. An optical communication device in accordance with claim 8, wherein each of said second plurality of optical signals further carries **destination information** associated with a corresponding one of said second plurality of optical signals.

14. A communication method comprising the steps of:
receiving a plurality of information streams;
encoding each of said plurality of information streams in accordance with a forward error correction code; and
transmitting a plurality of optical signals, each of which corresponding to a respective one of a plurality of optical channels, each of said plurality of optical signals being at a respective one of a plurality of wavelengths, selected ones of said plurality of wavelengths being spaced front one another by riot more than 1.6 mm, each of said plurality of optical signals carrying data associated with a respective one of said plurality of **encoded** information streams and **destination information** associated with a respective one of said plurality of optical channels.

20. An optical communication device, comprising:
a plurality of photodetectors, each being configured to sense a respective one of a first plurality of optical signals and output a corresponding ore of a first plurality of electrical signals in response thereto;
a plurality of **encoders** being configured to receive a respective one of said plurality of electrical signals, each of said plurality of **encoders** being **configured to encode** data carried by each of said first plurality of electrical signal in accordance with a forward error correction code, and output a respective one of a second plurality of electrical signals; and
a plurality of optical emitters each configured to output a respective one of a second plurality of optical signals in accordance with a respective one of said plurality of **encoded** data streams, each of said second plurality of optical signals being at a respective one of a plurality of wavelengths, selected ones of said second plurality of wavelengths being spaced from one another by not more than 1.6 rim, each of said plurality of optical signals carrying **destination information** associated with a corresponding one of said second plurality of optical signals.

27. An optical communication device in accordance with claim 25, wherein said information is **encoded** in accordance with a forward error correction code.

35. An optical communication device in accordance with claim 25, wherein each said selected one of said second plurality of optical signals carries respective **channel identification information**.

37. An optical communication device, comprising:
a plurality of photodetectors, each being configured to sense a respective one of a first plurality of optical signals and output a corresponding one of a first plurality of electrical signals in response thereto;
a plurality of **encoders** being configured to receive a respective one of said plurality of electrical signals, each of said plurality of **encoders** being **configured to encode** data carried by each of said first plurality of electrical signals in accordance with a forward error correction code, and output a respective one of a second plurality of electrical signals; and
a plurality of optical emitters, each configured to output a respective one of a second plurality of optical signals in accordance with a respective one of said plurality of **encoded** data streams, each of said second plurality of optical signals being at a respective one of a plurality of wavelengths, selected ones of said plurality of wavelengths being spaced from one another by not more than 1.6 nm.

U.S. PATENT NO. 5,978,115

5. An optical communication apparatus, comprising:
a first **wavelength division multiplexed terminal** coupled to a first end portion of an optical communication path, said first **wavelength division multiplexed terminal** being configured to supply a plurality of optical signals to an optical communication path, each of said plurality of optical signals being at a respective one of a plurality of wavelengths;
a second **wavelength division multiplexed terminal** coupled to a second end portion of said optical communication path, said second **wavelength division multiplexed terminal** receiving said plurality of optical signals; and

an interconnecting unit coupled to said second **wavelength division multiplexed terminal,** said interconnecting unit being configured to receive service channel data from said second **wavelength division multiplexed terminal** and supply said service channel data to a network.

8. An optical communication apparatus in accordance with claim 5, further comprising an additional interconnecting unit, said additional interconnecting unit coupling said first **wavelength division multiplexed terminal** to said network.

11. A method of supervising an optical transmission system, comprising the steps of:
monitoring a first optical component provided at a first location along an optical communication path, said optical communication path carrying a plurality of first optical signals, each of which being at a respective one of a plurality of first wavelengths;
modulating a second optical signal in accordance with information associated with said first optical component, said second optical signal being at a wavelength different than said plurality of first wavelengths;
supplying said second optical signal to said optical communication path;
detecting said second optical signal; and
controlling a second optical component provided at a second location spaced from said first location along said optical communication path based on said information.

12. A method in accordance with claim 11, wherein said first optical component comprises an in-fiber Bragg grating and said second optical component comprises a laser, said monitoring step further comprising the step of monitoring a temperature of said in-fiber Bragg grating.

U.S. PATENT NO. 6,163,392

1. A plurality of network elements provided in a wavelength division multiplexed (WDM) system, said wavelength division multiplexed system including an optical communication path carrying a plurality of WDM optical signals, each of said plurality of network elements comprising:
a first processor having an output carrying identification information of a respective one of said network elements; and
a service channel modem coupled to said output of said first processor, said service channel modem being **configured to supply service channel optical signals** carrying said identification information to said optical communication path, said service channel optical signals having a wavelength different than wavelengths associated with said WDM optical signals, said service channel modem further including:
a second processor coupled to said first processor;
a light emitting element coupled to said second processor, said light emitting element generating first ones of said service channel optical signals in accordance with said identification information; and
a light receiving element coupled to said optical communication path and being configured to sense second ones of said service channel optical signals.

U.S. PATENT NO. 6,278,535

1. A method for monitoring portions of a data stream, said method comprising the steps of:

extracting each of a first **plurality of data segments from a respective one of a** first **plurality of data frames** included in said data stream;
assembling said first plurality of data segments into a first message;
storing said first message in a first memory circuit;
extracting each of a second **plurality of data segments from a respective one of a** second **plurality of frames** included in said data stream;
assembling said second plurality of data segments into a second message;
storing said second message in a second memory circuit;
comparing said first message with said second message; and
generating an alarm signal in response to said comparison of said first and second messages.

4. A method in accordance with claim 1, wherein each of said first plurality of **data frames** and each of said second plurality of **data frames** are in a SONET format.

5. A method in accordance with claim 1, wherein each of said first plurality of **data frames** and each of said second plurality of **data frames** are in an SDH format.

8. A method for monitoring portions of a data stream, comprising the steps of:
extracting each of a plurality of data segments from a respective one of a plurality of data frames included in said data stream;
assembling said plurality of first data segments into a first message;
storing said first message in a first memory circuit;
storing a second predetermined message in a second memory circuit;
comparing said first message with said second predetermined message; and
generating an alarm signal in response to said comparison of said first message and said second predetermined message.

10. A method in accordance with claim 8, wherein each of said plurality of **data frames** is in a SONET format.

11. A method in accordance with claim 8, wherein each of said plurality of **data frames** is in an SDH format.

12. A method in accordance with claim 8, wherein each of said plurality of data segments includes a J0 byte from each of said plurality of **data frames**.

13. A data communication apparatus, comprising:
a data path carrying a plurality of **data frames**;
an extraction circuit coupled to said data path, said **extraction circuit outputting a plurality of data segments, each of which being selected from a respective one of said plurality of data frames**;
a first memory circuit coupled to said extraction circuit, said first memory circuit receiving and storing first ones of said plurality of data segments as a first message;
a second memory circuit coupled to said extraction circuit, said second memory circuit receiving and storing second ones of said plurality of data segments as a second message; and
a comparison circuit coupled to said first and second memory circuits, said comparison circuit comparing said first and second messages and generating an output signal in response to said comparison.

20. A data communication apparatus in accordance with claim 13, wherein each of said plurality of **data frames** is in a SONET format.

21. A data communication apparatus in accordance with claim 13, wherein each of said plurality of **data frames** is in an SDH format.

22. A data communication apparatus, comprising:

an optical-to-electrical conversion element having an input coupled to an optical communication path and an output, said optical-to-electrical conversion element receiving optical signals carried by said optical communication path at said input and generating electrical signals in response thereto at said output;

a data recovery circuit coupled to said optical-to-electrical conversion element, said data recovery circuit generating a stream of data signals in response to said electrical signals, said data signals including a plurality of **frames**;

an electronic data path coupled to said data recovery circuit and carrying said stream of data signals;

an extraction circuit coupled to said electronic data path, said **extraction circuit selecting each of a plurality of data segments from a respective one of said plurality of frames**;

a first memory circuit coupled to said extraction circuit, said first memory circuit storing first ones of said plurality of data segments as a first message;

a second memory circuit coupled to said extraction circuit, said second memory circuit storing second ones of said plurality of data segments as a second message; and

a comparison circuit coupled to said first and second memory circuits, said comparison circuit comparing said first and second messages and generating a comparison signal in response thereto.

U.S. PATENT NO. 4,667,324

1. A digital transmission system comprising:

means including bit stuffing means, for time-division multiplexing bit streams from a plurality of tributaries into a multiplexed bit stream;

at least one of the bit streams from the plurality of tributaries being divisible into frames, each frame being divisible into a plurality of channels of equal bit length and hav1ng at 1east one additional overhead control bit;

characterized by:

the bit stuffing means inserts additional bits in each bit stream from the plurality of tributaries so that the number of bits per frame of said one bit stream in the multiplexed bit stream is an integer number of the number of bits per channel, and so that the number of bits per frame of each of the other bit streams in the multiplexed bit stream is an integer number of said number of bits per frame of said one bit stream long.

3. A digital transmission system for the transmission of bit streams from a plurality of tributaries, comprising:

means for time-division multiplexing said bit streams into a multiplexed bit stream, at least one of the bit streams being divided into frames, each frame having m channels each n bits long and also having at least one additional control bit;

characterized by:

means for stuffing additional bits in said one bit stream to increase the resultant number of bits from the one stuffed frame in the multiplexed bit stream to kn, where k is a positive integer;

means for stuffing additional bits in each of the other bit streams to increase the resultant number of bits from each of the other stuffed frames in the multiplexed bit stream to jkn, where j is a positive integer for each of the other stuffed frames.

U.S. PATENT NO. 4,736,363

1. A path-oriented routing method for packet switching networks, wherein said network is comprised of a plurality of interconnected packet switches wherein at any given period of time each said **packet switch** can be functioning as a **destination switch**, an **originating switch**, a **tandem switch**, or any combination of the preceding, said method characterized by:
each given **packet switch** broadcasting to all its **adjacent neighbouring switches** a preferred single path identifier to use to send messages to it; and
each successive **packet switch**, moving monotonically in a direction away from said given **packet switch**, broadcasting to all its **adjacent neighbouring switches**, the preferred single path identifier to use to send messages to it destined ultimately for said given **packet switch**.

2. A path-oriented routing system for packet switching networks, wherein said network is comprised of a plurality of interconnected packet switches, said system characterized by:
a single path identifier being associated with each packet at the source **packet switch** and carried by the packet as it traverses through said network to a given **destination switch**, said single path identifier being updated at each **packet switch** traversed.

3. The path-oriented routing system of claim 2 wherein each said **packet switch** maintains information concerning the **shortest path** from itself to a given **destination switch**, and in addition maintains information for relating the incoming single path identifier to both a single outgoing path identifier to be appended to a packet and a trunk identifier to be used locally by said **packet switch**.

4. A method of routing packets of information on a packet switching network comprised of a plurality of interconnected packet switches, said method characterized by:

assigning to each said packet as it is being assembled, a single path identifier indicative of the path said packet is to follow on the way to its destination;

updating periodically said single path identifier that is to be assigned to the packet at the **originating switch**, wherein packets corresponding to new connections may be assigned new path identifiers, while packets corresponding to existing connections continue to employ the same path identifier as did earlier packets in the same connection and

routing each said packet, at each said **packet switch**, to the path indicated by said single path identifier.

U.S. PATENT NO. 6,205,142

1. A method of **inverse multiplexing digital data over a connection consisting of a plurality of transmission links**, said data containing a series of ATM data cells, comprising steps of:

sending a series of inverse multiplexing control cells indicating a specific round robin order in which

the series of ATM data cells are to be transmitted over the connection;

receiving from the plurality of transmission links a series of inverse multiplexing control cells whose receive ready field is set;

sending each ATM data cell in said series of ATM data cells in said specific round robin order; and

further sending two consecutive inverse multiplexing control cells in a frame, indicating cell stuffing.

3. A method of inverse multiplexing digital data over a connection having a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, the method comprising:

transmitting from a first node a series of inverse multiplexing control cells indicating a round robin order in which the ATM data cells are to be transmitted over the connection;

receiving at the first node a series of inverse multiplexing control cells whose receive ready field is set;

transmitting from the first node the series of ATM data cells in the round robin order, the first node inserting at least one inverse multiplexing control cell that contains **cell stuff information** into each frame.

4. The method of claim 3, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

6. A method of establishing a communication link for inverse multiplexing digital data from a source node to a destination node over a connection including a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising:

initiating the connection by transmitting from the source node one or more inverse multiplexing control cells containing information defining a round robin order in which the series of ATM data cells are to be transmitted over the connection; receiving at the source node one or more inverse multiplexing control cells containing information indicating that the destination node is ready to receive ATM data cells in the round robin order over the connection; and sending the series of ATM data cells in the round robin order to the destination node, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

7. The method of claim 6, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

9. A method of inverse multiplexing digital data from a source node to a destination node over a connection including a plurality of transmission links, the data including a series of ATM data cells that is segmented into a plurality of frames, comprising:

initiating the connection between the source node and the destination node by transmitting from the source node one or more inverse multiplexing control cells containing information defining a round robin order in which the series of ATM data cells are to be transmitted over the connection;

receiving at the source node one or more inverse multiplexing control cells containing information indicating that the destination node is ready to receive ATM data cells in the round robin order over

the connection; and transmitting the series of ATM data cells to the destination node in the round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

10. The method of claim 9, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

12. A method of inverse multiplexing digital data to be transmitted from a source node to a destination node using a plurality of communication links, comprising the steps of:

transmitting from the source node to the destination node one or more inverse multiplexing control cells including information identifying a specific order in which a series of ATM data cells that is segmented into a plurality of frames are to be transmitted over the plurality of communication links;

transmitting from the destination node to the source node one or more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells in the specific order; and transmitting from the source node to the destination node the series of ATM data cells in the specific order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

13. The method of claim 12, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

15. A method at a source node of inverse multiplexing digital data to be transmitted from the source node to a destination node using a plurality of communication links, comprising: transmitting from the source node to the destination node one or more inverse multiplexing control cells including information identifying an order in which a series of ATM data cells that is segmented into a plurality of frames are to be transmitted over the plurality of communication links;

receiving at the source node transmitted from the destination node one or more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells in the specified order; and transmitting from the source node to the destination node the series of ATM data cells in the specified order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

16. The method of claim 15, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

18. A method, for use at a destination node, of receiving inverse multiplexed digital data transmitted from a source node using a plurality of communication links, comprising:

receiving from the source node, one or more inverse multiplexing control cells including information identifying an order in which a series of ATM data cells that is segmented into a plurality of frames are to be transmitted over the plurality of communication links; transmitting one or more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells in the order;

receiving the series of ATM data cells transmitted from the source node in the order; wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

19. The method of claim 18, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

21. A method of inverse multiplexing digital data from a source node to a destination node over a connection including a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising:

the source node sending to the destination node one or more inverse multiplexing control cells informing the destination node of a round robin order in which the series of ATM data cells are to be transmitted over the connection;

the destination node sending one or more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells in the round robin order from the plurality of transmission links; and the source node sending the series of ATM data cells to the destination node in the round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

22. The method of claim 21, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

24. A method of inverse multiplexing digital data over a connection including a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising:

sending to a destination node one or more inverse multiplexing control cells indicating a specific round robin order in which the series of ATM data cells are to be transmitted over the connection;

receiving from the destination node one or more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells;

sending the series of ATM data cells to the destination node in the specific round robin order, wherein each frame includes at least one inverse multiplexing control cell that contain **cell stuff information**.

25. The method of claim 24, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

27. A method of inverse multiplexing digital data over a connection including a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising receiving at a destination node from a source node one or more inverse multiplexing control cells indicating a specific round robin order in which the series of ATM data cells are to be transmitted over the connection; transmitting from the destination node to the source node one or more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells;

receiving the series of ATM data cells at the destination node in the specific round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

28. The method of claim 27, wherein the **cell stuff information** includes stuff code

indicating the location of stuff cells inserted in a respective frame.

30. A method of inverse multiplexing digital data from a first node to a second node over a connection consisting of a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising:

whenever the connection is to be reconfigured, the first node sending to the second node one or more inverse multiplexing control cells containing information indicating a specific round robin order in which the series of ATM data cells are to be transmitted over the connection;

receiving at the first node from the second node, one or more inverse multiplexing control cells containing information indicating that the second node is ready to receive ATM data cells in the specific round robin order from the plurality of transmission links;

sending each ATM data cell in the series of ATM data cells from the first node to the second node in the specific round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

31. The method of claim 30, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

33. A method of inverse multiplexing digital data from a first node to a second node over a connection consisting of a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising:

whenever the connection is to be reconfigured, the second node receiving from the first node one or more inverse multiplexing control cells containing information indicating a specific round robin order in which the series of ATM data cells are to be transmitted over the connection;

sending from the second node to the first node, one or more inverse multiplexing control cells containing information indicating that the second node is ready to receive ATM data cells in the specific round robin order from the plurality of transmission links; receiving at the second node each ATM data cell in the series of ATM data cells from the first node in the specific round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

34. The method of claim 33, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

36. A node in an ATM communications system for inverse multiplexing digital data from a source node to a destination node over a connection including a plurality of transmission links, comprising: a transmitting device for transmitting from the source node one or more inverse multiplexing control cells containing information defining a round robin order in which a series of ATM data cells that is segmented into a plurality of frames are to be transmitted over the connection;

a receiving device for receiving at the source node, inverse multiplexing control cells containing information indicating that the destination node is ready to receive ATM data cells in the round robin order from the plurality of transmission links; and a data cell transmitting device for transmitting to the receiving node, the series of ATM data cells in the round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

37. The node of claim 36, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

39. A node in an ATM communications system for inverse multiplexing digital data from a source node to a destination node over a connection including a plurality of transmission links, the data including a series of ATM data cells that is segmented into a plurality of frames, comprising:

a transmitting device that transmits from the source node one or more inverse multiplexing control cells containing information defining a round robin order in which the series of ATM data cells are to be transmitted over the connection;

a receiving device for receiving at the source node, one or more inverse multiplexing control cells containing information indicating that the destination node is ready to receive ATM data cells in the round robin order from the plurality of transmission links; and a data cell transmitting device for transmitting the series of ATM data cells to the destination node in the round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

40. The node of claim 39, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

42. A node in an ATM communications system for inverse multiplexing digital data to be transmitted from a source node to a destination node using a plurality of communication links, comprising:

a transmitting device for transmitting from the source node to the destination node one or more inverse multiplexing control cells including information identifying a specific order in which a series of ATM data cells that is segmented into a plurality of frames are to be transmitted over the plurality of communication links;

a transmitting device for transmitting from the destination node to the source node one or more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells in the specific order; and a data cell transmitting device for transmitting from the source node to the destination node the series of ATM data cells in the specific order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

43. The node of claim 42, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

45. A node in an ATM communications system for inverse multiplexing digital data to be transmitted from a source node to a destination node using a plurality of communication links, comprising:

a transmitting device for transmitting from the source node to the destination node one or more inverse multiplexing control cells including information identifying a specific order in which a series of ATM data cells that is segmented into a plurality of frames are to be transmitted over the plurality of communication links;

a receiving device for receiving at the source node transmitted from the destination node, one or

more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells in the specific order; and a data cell transmitting device for transmitting from the source node to the destination node the series of ATM data cells in the specific order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

46. The node of claim 45, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

48. A node in an ATM communications system for receiving inverse multiplexed digital data transmitted from a source node to the destination node using a plurality of communication links, comprising:

a receiving device that receives at the destination node one or more inverse multiplexing control cells transmitted from the source node, wherein the inverse multiplexing control cells include information identifying a specific order in which a series of ATM data cells that is segmented into a plurality of frames are to be transmitted over the plurality of communication links;

a transmitting device transmitting from the destination node to the source node, one or more inverse multiplexing cells including information indicating that the destination node is ready to receive ATM data cells in the specific order; and a data cell receiving device that receives at the destination nodes the series, of ATM data cells transmitted from the source node in the specific order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

49. The node of claim 48, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

51. A node in an ATM communications system for inverse multiplexing digital data from a source node to a destination node over a connection including a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising:

a transmitting device for sending from the source node to the destination node, at a connection start-up, one or more inverse multiplexing control cells informing the destination node of a specific round robin order in which the series of ATM data cells are to be transmitted over the connection;

a transmitting device for sending one or more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells in the specific round robin order from the plurality of transmission links; and a data cell transmitting device for sending the series of ATM data cells to the destination node in the specific round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

52. The node of claim 51, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

54. A node in an ATM communications system for inverse multiplexing digital data over a connection including a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising:

a transmitting device for sending to a destination node one or more inverse multiplexing control cells

indicating a specific round robin order in which the series of ATM data cells are to be transmitted over the connection;

a receiving device for receiving from the destination node one or more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells; and a data cell transmitting device for sending the series of ATM data cells to the destination node in the specific round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

55. The node of claim 54, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

57. A node in an ATM communication system for inverse multiplexing digital data over a connection including a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising:

a receiving device for receiving at a destination node from a source node one or more inverse multiplexing control cells indicating a specific round robin order in which the series of ATM data cells are to be transmitted over the connection;

a transmitting device for transmitting from the destination node one or more inverse multiplexing control cells including information indicating that the destination node is ready to receive ATM data cells; and a data cell receiving device for receiving the series of ATM data cells at the destination node in the specific round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

58. The node of claim 57, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

60. A node in an ATM communication system for inverse multiplexing digital data to another node over a connection consisting of a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising:

a transmitting device for sending to the other node, whenever the connection is to be reconfigured, one or more inverse multiplexing control cells containing information indicating a specific round robin order in which the series of ATM data cells are to be transmitted over the connection;

a receiving device for receiving from the other node, inverse multiplexing control cells containing information indicating that the other node is ready to receive ATM data cells in the specific round robin order from the plurality of transmission links; and a data cell transmitting device for sending each ATM data cell in the series of ATM data cells to the other node in the specific round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

61. The node of claim 60, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

63. A node in an ATM communication system for inverse multiplexing digital data to another node over a connection consisting of a plurality of transmission links, the data containing a series of ATM data cells that is segmented into a plurality of frames, comprising:

a receiving device for receiving at the other node, whenever the connection is to be reconfigured, one or more cells containing information indicating a specific round robin order in which the series of ATM data cells are to be transmitted over the connection;

a transmitting device for sending from the other node, inverse multiplexing control cells containing information indicating that the other node is ready to receive ATM data cells in the specific round robin order from the plurality of transmission links; and

a receiving device for receiving at the other node each ATM data cell in the series of ATM data cells in the specific round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

64. The node of claim 63, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

66. A node in an ATM communications system for inverse multiplexing digital data to be transmitted from a source node to a destination node using a plurality of communication links, comprising:

means for transmitting from the source node to the destination node one or more inverse multiplexing control cells including information identifying a specific order in which a series of ATM data cells that is segmented into a plurality of frames are to be transmitted over the plurality of communication links;

means for transmitting from the destination node to the source node one or more inverse multiplexing control cells that include information indicating that the destination node is ready to receive ATM data cells in the specific order;

means for transmitting from the source node to the destination node the series of ATM data cells in the specific order; wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

67. The node of claim 66, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

69. A system for inverse multiplexing digital data from one node to another node over a connection, the data containing a series of ATM data cells that is segmented into a plurality of frames, the system comprising:

a plurality of transmission links in communication with the one node;

a transmitting device for transmitting from the one node one or more cells containing information defining a round robin order in which a series of ATM data cells are to be transmitted over the connection;

a receiving device for receiving at the one node cells containing information indicating that the another node is ready to receive ATM data cells in the round robin order from the plurality of transmission links and

a data cell transmitting device for transmitting from the one node to the another node, the series of ATM data cells, wherein each frame includes at least one inverse multiplexing control cell that

contains **cell stuff information**.

70. The system of claim 69, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

72. A method of inverse multiplexing digital data from a source node to a destination node over a connection consisting of a plurality of transmission links, said data containing a series of ATM data cells that are segmented into a plurality of frames, comprising steps of:

sending, at a connection start-up, from the source node to the destination node, inverse multiplexing control cells informing the latter of a specific round robin order in which the series of ATM data cells are to be transmitted over the connection;

the destination node sending inverse multiplexing control cells whose receive ready field is set to indicate that the destination node is ready to receive ATM data cells in said specific round robin order from the plurality of transmission links; and the source node sending each ATM data cell in said series of ATM data cells that are arranged into a plurality of frames, to the destination node in said specific round robin order, wherein each frame includes at least one inverse multiplexing control cell that contains **cell stuff information**.

73. The method of claim 72, wherein the **cell stuff information** includes stuff code indicating the location of stuff cells inserted in a respective frame.

U.S. PATENT NO. 5,841,760

3. A transparent multiplexer/demultiplexer (T-Mux) comprising:

a plurality (K) of trib ports, a trib port for receiving a trib SONET OC-N signal from a corresponding trib network and separating same into N trib synchronous payload envelopes (SPE) and N trib overheads (OH), interleaved in a standardized order;

a supercarrier port for generating a supercarrier SONET OC-(N.times.K) signal comprising a supercarrier SPE and a supercarrier OH;

a payload manager for multiplexing all said trib SPEs into said supercarrier SPE and providing same to said supercarrier port;

a supercarrier transmit OH processor for generating the bytes of said supercarrier OH and for providing same to said supercarrier port; and

a trib receive OH processor for **distinctly manipulating the bytes of each said trib OH** and providing same to said supercarrier transmit OH processor,

where K is an integer selected according to the rate of each said tributary signal and the rate of said supercarrier signal and N is the rate of any trib signal as defined by SONET/SDH standards.

24. In a plurality (K) of trib systems for transporting trib signals of between a multitude of sites, all trib systems having in common a first and a second site, a method of carrying said trib signals between said first and second site with **no change to the provisioning of any of said trib**

systems, comprising, at said first site, the steps of:

providing a first site rib port for each said trib system, and connecting each said first site trib port to a corresponding trib system T.sub.k over a forward trib span;

at each said first site trib port, receiving a forward trib signal of a trib bit rate and multiplexing all said forward trib signals into a forward supercarrier signal of a supercarrier bit rate comprising OAM&P information on each said forward trib signal and said forward supercarrier carrier signal;

providing a first site supercarrier port and connecting said first site supercarrier port to said second site over a high rate span and transmitting said forward supercarrier signal from said first site supercarrier port to said second site,

where K is an integer selected according to the rate of each said tributary signal.

15. A transparent multiplexer/demultiplexer (T-Mux) comprising:

a supercarrier port for receiving a supercarrier SONET OC-(N.times.K) signal and separating same into a supercarrier SPE and a supercarrier OH, wherein said supercarrier SPE comprises N.times.K component STS-1 SPEs and said supercarrier OH comprises N.times.K corresponding STS-1 OHs, interleaved in a predetermined order;

a plurality (K) of trib ports, a trib port for receiving a trib SPE and a trib overhead (OH), generating therefrom a trib signal and transmitting same over a corresponding trib network;

a payload manager for de-multiplexing said supercarrier SPE into said trib SPEs and providing each trib SPE to a corresponding said trib port;

a trib transmit OH processor for generating the bytes of each said trib OH and providing same to a corresponding trib port; and

a supercarrier receive OH processor for **distinctly manipulating the bytes of said supercarrier OH** and for providing same to said trib transmit OH processor,

where K is an integer selected according to the rate of each said tributary signal and the rate of said supercarrier signal and N is the rate of any trib signal as defined by SONET/SDH standards.

U.S. PATENT NO. 6,496,519

1. A method of communicating **Ethernet** frame based data over a synchronous digital network comprising the steps of:

rate adapting said Ethernet frame based data by adapting an Ethernet data frame to at least one bit stream, each bit stream having a data rate which can be multiplexed into a synchronous digital network virtual container;

providing at least one **synchronous digital network virtual container** having a data rate which is compatible with said at least one bit stream data rate formed by adapted **Ethernet** frame based data; and

inputting said bit stream into at least one **synchronous digital network virtual container**;

wherein said **Ethernet** data frame received at a higher rate than the rate at which said at least one bit stream is input into said at least one **synchronous digital network virtual container**, and wherein the **Ethernet** frame based data is received from an **Ethernet** frame switch, and wherein the rate at which the **Ethernet** data frames are received is controlled by sending signals back to said **Ethernet** frame switch to delay sending a further **Ethernet** frame until sufficient storage capacity is available to accept new **Ethernet** data frames for said step of rate adaptation.

2. The method as claimed in claim 1, wherein the step of providing at least one **synchronous digital network virtual container** comprises the step of:

concatenating a plurality of said virtual containers together to provide a synchronous digital network data rate which is compatible with the data rate of said **Ethernet** data; and wherein the step of inputting said bit stream comprising said **Ethernet** frame based data into at least one **synchronous digital network virtual container** comprises inputting said **Ethernet** frame based data into said plurality of concatenated virtual containers.

3. A method as claimed in claim 1, wherein the **Ethernet** data frames are adapted to at least one bit stream whose data rate is taken from the group consisting of: 2 Mbits/s, 50 Mbits/s, and 100 Mbits/s.

4. A method as claimed in claim 1, wherein the **Ethernet** frame based data is received from an **Ethernet** frame switch.

23. A method of communicating **Ethernet** frame based data over a synchronous digital network comprising the steps of:

rate adapting said Ethernet frame based data by adapting an Ethernet data frame to at least one bit stream, each bit stream having a data rate which can be multiplexed into a synchronous digital network virtual container;

providing at least one **synchronous digital network virtual container** having a data rate which is compatible with said at least one bit stream data rate formed by adapted **Ethernet** frame based data; and

inputting said bit stream into at least one **synchronous digital network virtual container**;

wherein said **Ethernet** data frame received at a higher rate than the rate at which said at least one bit stream is input into said at least one **synchronous digital network virtual container**, wherein the **Ethernet** data frames are adapted to at least one bit stream whose data rate is taken from the group consisting of: 2 Mbits/s, 50 Mbits/s, and 100 Mbits/s.

24. A method of communicating **Ethernet** frame based data over a synchronous digital network comprising the steps of:

rate adapting said Ethernet frame based data by adapting an Ethernet data frame to at least one bit stream, each bit stream having a data rate which can be multiplexed into a synchronous digital network virtual container;

providing at least one **synchronous digital network virtual container** having a data rate which is compatible with said at least one bit stream data rate formed by adapted **Ethernet** frame based data; and inputting said bit stream into at least one **synchronous digital network virtual container**;

wherein said **Ethernet** data frame received at a higher rate than the rate at which said at least one bit stream is input into said at least one **synchronous digital network virtual container**, wherein the step of providing at least one **synchronous digital network virtual container** comprises the step of:

concatenating a plurality of said virtual containers together to provide a synchronous digital network data rate which is compatible with the data rate of said **Ethernet** data; and wherein the step of inputting said bit stream comprising said **Ethernet** frame based data into at least one **synchronous digital network virtual container** comprises inputting said **Ethernet** frame based data into said plurality of concatenated virtual containers.

APPENDIX B

CLAIMS CONSTRUCTION FOR U.S. PATENT NO. 5,715,076

Claim Language	Court's Construction
remodulating channel selector claims 1-3, 5-11	no construction needed
optical input port claims 1, 9-10	no construction needed
remodulating channel selector output port claim 1	no construction needed
optical channel selector claims 1, 2, 11	device that selects a single optical channel from a wavelength division multiplexing input signal

CLAIMS CONSTRUCTION FOR U.S. PATENT NO. 6,618,176

Claim Language	Court's Construction
encoded **encoders** **configured to encode** **encoding** claims 1, 8, 14, 20, 27, 37	adding coding bits component(s) for adding coding bits configured to add coding bits having coding bits added

source information **destination information** **channel identification information** claims 1, 7, 8, 13, 14, 20, 35	information identifying the source, destination, or channel

CLAIMS CONSTRUCTION FOR U.S. PATENT NO. 5,978,115

Claim Language	Court's Construction
monitoring a first optical component **modulating a second optical component** claims 11, 12	the activities of "monitoring a first optical component" and "modulating a second optical signal" occur "at the location of the first optical component"
detecting said second optical signal **controlling a second optical component** claim 11	the activities of "detecting a second optical signal" and "controlling a second optical component" occur "at the location of the second optical component"
wavelength division multiplexed terminal claims 5, 8	terminal at the end of a communication pathway having a transmitter and/or receiver for wavelength division multiplexing communications

CLAIMS CONSTRUCTION FOR U.S. PATENT NO. 6,163,392

Claim Language	Court's Construction
configured to supply service channel optical signal claim 1	programmed to supply service channel optical signals

CLAIMS CONSTRUCTION FOR U.S. PATENT NO. 6,278,535

Claim Language	Court's Construction
data frames **frames** claims 1, 4, 5, 8, 10, 11, 12, 13, 20, 21, 22	no construction needed
extracting each of a . . . plurality of data segments from a respective one of a . . . plurality of data frames **extracting each of a plurality of data segments from a respective one of a plurality of data frames** claims 1, 8	extracting a data segment from each of a plurality of data frames

extraction circuit outputting a plurality of data segments, each of which being selected from a respective one of said plurality of data frames **extraction circuit selecting each of a plurality of data segments from a respective one of said plurality of frames** claims 13, 22	circuit extracting a data segment from each of a plurality of data frames

CLAIMS CONSTRUCTION FOR U.S. PATENT NO. 4,667,324

Claim Language	Court's Construction
means including bit stuffing means, for time-division multiplexing bit streams from a plurality of tributaries into a multiplexed bit stream claim 1	**Function:** time-division multiplexing bit streams from a plurality of tributaries into a multiplexed bit stream, including inserting additional bits in each bit stream from the plurality of tributaries **Structure:** multiplexing and bit-stuffing circuitry, for example: multiplexer 10; and bit stuffers 11, 12, 13, and 14, shown in Figure 2, and equivalents thereof
means for time-division multiplexing said bit streams into a multiplexed bit stream, at least one of the bit streams being divided into frames, each frame having m channels each n bits long and also having at least one additional control bit claim 3	**Function:** time-division multiplexing said bit streams into a multiplexed bit stream, at least one of the bit streams being divided into frames, each frame having m channels each n bits long and also having at least one additional bit used for synchronization and signaling control of the data frames **Structure:** multiplexing circuitry, for example: multiplexer 10 shown in Figure 2 and equivalents thereof

means for stuffing additional bits in said one bit stream to increase the resultant number of bits from the one stuffed frame in the multiplexed bit stream to kn, where k is a positive integer claim 3	**Function**: stuffing additional bits in said one bit stream to increase the resultant number of bits from the one stuffed frame in the multiplexed bit stream to kn, where k is a positive integer **Structure:** bit stuffing circuitry, for example: bit stuffers 11, 12, 13, and 14 in Figure 2 and equivalents thereof
means for stuffing additional bits in each of the other bit streams to increase the resultant number of bits from each of the other stuffed frames in the multiplexed bit stream to jkn, where j is a positive integer for each of the other stuffed frames claim 3	**Function:** stuffing additional bits in each of the other bit streams to increase the resultant number of bits from each of the other stuffed frames in the multiplexed bit stream to jkn, where j is a positive integer for each of the other stuffed frames **Structure:** bit stuffing circuitry for example: bit stuffers 11, 12, 13, and 14 in Figure 2 and equivalents thereof

CLAIMS CONSTRUCTION FOR U.S. PATENT NO. 4,736,363

Claim Language	Court's Construction
destination switch claims 1-3	packet switch for which a packet is destined
tandem switch claim 1	an intermediate switch other than the originating and destination switches
adjacent neighboring switches claim 1	switches coupled with another switch
originating switch claims 1, 4	the first packet switch to forward a packet destined for the destination switch

packet switch claims 1-4	a routing device that forwards packets
shortest path claim 3	path through the network having the shortest distance (this is, for example, "cost" or "delay")

CLAIMS CONSTRUCTION FOR U.S. PATENT NO. 6,205,142

Claim Language	Court's Construction
inverse multiplexing digital data over a connection consisting of a plurality of transmission links claim 1	no construction needed
cell stuff information claims 3, 4, 6, 7, 9, 10, 12, 13	information relating to cell stuffing

CLAIMS CONSTRUCTION FOR U.S. PATENT NO. 5,841,760

Claim Language	Court's Construction
no change to the provisioning of any of said trib systems claim 24	no construction needed
distinctly manipulating the bytes of each said trib OH claim 3	manipulating in a distinct manner each of the overhead bytes, or a group of bytes, of each of the tributary signals

distinctly manipulating the bytes of each said supercarrier OH claim 15	manipulating in a distinct manner each of the overhead bytes, or a group of bytes, of each of the tributary signals

CLAIMS CONSTRUCTION FOR U.S. PATENT NO. 6,496,519

Claim Language	Court's Construction
rate adapting said Ethernet frame based data by adapting an Ethernet data frame to at least one bit stream, each bit stream having a data rate which can be multiplexed into a synchronous digital network virtual container claims 1, 23, 24	converting Ethernet frame based data and the data rate into one or more bit streams, each bit stream has a data rate which can be multiplexed into a synchronous digital network virtual container, the bit stream is not encapsulated in an intermediate format
synchronous digital network virtual container claims 1, 2, 23, 24	no construction needed
Ethernet claims 1, 2, 3, 4, 23, 24	data communications protocol available in 10 Mbits/s, 100 Mbits/s and 1 GigaBits/s versions